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JOURNAL

OF

GAS LIGHTING,

WATER SUPPLY,

ETC.

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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EDITORIAL NOTES—GAS, &c.

New Acts Affecting Industry.

THE sittings of Parliament last year were remarkable for many things; among them the largeness of the legislative output affecting industry. The session was, so far as memory serves, without parallel in this regard; and it will behove all associated with industrial management in any way to make themselves fully acquainted with the provisions of certain of the new Acts. The measures referred to are the Workmen's Compensation Act, the Trades Disputes Act, the Notice of Accidents Act, the Census of Production Act, the Alkali Works Act, and the Prevention of Corruption Act. Those of the measures not yet published will shortly be procurable by those who desire possession.

We are not among those who begrudge the fullest possible attention that Parliament can bestow upon questions affecting the well-being and protection of the workers of industry and commerce, providing there is not, as the result, preferential treatment of one section of the body-politic over other and equally necessary and important sections. Labour has been granted a very big slice of the past parliamentary year; and it must be regretted by all who have the best interests of the country's workers at heart that the legislation in which they are concerned has been of a character in which the scales of justice have been inequitably held as between employer and employee. Those who think deeply, and those who are far-sighted, will consider and look beyond the provisions of the Compensation, Trades Disputes, and Notice of Accidents Acts for their effect; and they are certain to come to the conclusion that largely the effect will be controlled by the employer. As the compensation screw has been tightened, as the Trades Unions have been given preferential freedom, and as the obligations of the employer and his anxieties have been increased under the Notice of Accidents Act, it will be to his interest to reduce, as far as possible, his reliance upon manual labour. The Government, whipped up by the pseudo-friends of labour, have acted not in accordance with their own intelligence, but at the dictation of interested parties, without regard for the consequences. If it had been the wish of the Government to specially legislate for the acceleration of the adoption of labour-saving machinery, and for the displacement of elderly and unskilled workers, they could not have carried through measures better calculated to do this than the Compensation, Trades Disputes, and Notices of Accidents Acts of the past session.

The employer will naturally do his best to escape to the utmost from the leashes of these Acts. In his own protection, he will adopt machinery wherever possible, in preference to manual labour. Machinery requires maintenance, which is an approximately known quantity; compensation, with the door thrown wide open, and so many factors contributing to the necessary conditions for its production, is an unknown quantity—whether relating to magnitude, duration, or frequency. The employer will weed out to the fullest possible extent those who, through age, infirmity, incompetence, or carelessness, are likely to be the means of endangering him or causing him trouble in any way; and he will increase his care to confine his employees to those upon whom he feels that he can rely. The new Compensation Act narrows the protection that the employer had under the former Acts; and it is only natural that he should seek to lessen his responsibility by using every available means for reducing his dependence upon labour. The imposition of greater insurance liabilities on, or the necessity for the provision of funds in other ways by, employers—especially small ones—must result in attempts to compensate the liability by reducing wages, and in the supersession by non-society men of trade unionists who will not work for lower wages. The Trades Disputes Act gives additional reason to the employer for placing himself to the fullest extent beyond the tyranny of Trades Unionism, in view of the elimination by the Act of the possibility of recovery from the Unions of damages for injury sustained by their aggressive procedure.

The broadness of the Compensation Act appears to be little understood at the moment. It has brought practically all personal injury, however trivial, under the ægis of compensation; and the ægis of compensation has been enlarged so as to include all persons—save policemen, outworkers, and men of the Army or Navy—who have entered into, or work under, a contract of service or apprenticeship, whether by way of manual labour, clerical work, or otherwise, and whether the contract is expressed or implied, is oral or in writing. According to Mr. Herbert Gladstone, the Act of 1897 brought six million persons within its operation; the Act of 1900, an additional million; and the new Act will add six millions more. We will not enter into the question of malingering, and the many other matters raised in the course of the debates over this measure. The Act is only treated here in the light of the ill-effect that over-legislation of the kind must have on the interests of labour.

The Trades Disputes Act has been so much in evidence in the Daily Press that all engaged in industrial management must have a general knowledge as to what the Act has done in elevating to a privileged position Trades Unionism, and in giving complete immunity to the funds of the Unions. In the King's Speech on the prorogation of Parliament, the hope was expressed that the Trades Disputes Act had removed all legitimate cause of grievance. One may hope, but still feel that the hope is a vain one. If the Act had been intentionally constructed with the object of creating and embittering industrial trouble, the work of construction could not have been better done. The Act has been severely criticized by most eminent jurists, politicians, and employers of labour, as one from which equity has been entirely banished at the dictation of the trades unionists and socialistic demagogues who now sit in Parliament. Then there is the Notice of Accidents Act, which, as was pointed out in the "JOURNAL" on April 17 last (when the measure was still in its first stages), makes more stringent the obligation of employers in respect of accidents than under the Notice of Accidents Act of 1894; and the most paltry accidents will now have to be brought to official knowledge. The three Acts so far referred to must be read together, in considering what will be the ultimate effect of this stiffening of labour legislation as against employers. It can only, as already remarked, increase their inclination to sacrifice manual for mechanical aid wherever possible.

Regarding the other Acts mentioned in the opening paragraph, the Census of Production Act provides for the compilation of a census of production and statistics of the trade of the country. Next year has been the one prescribed for the first census; and subsequent ones will be at the discretion of the Board of Trade. The Alkali Works Act, which was principally directed to the greater regulation of the emission of noxious gases or other waste from alkali works, received the Royal Assent prior to the August adjournment of Parliament, and was fully noticed in the "JOURNAL" for Aug. 28 last. The Prevention of Corruption Act comes into operation from to-day. It has been dealt with so recently in our columns that there is nothing more to be said about it, excepting to express the hope that its intention of producing greater purity in commercial transactions will be fulfilled. If the good wishes of honest men will produce success, then the success of this Act is fully assured.

Features of Gas Bills—Testing and Discounts.

THE recent publication of the notices of the Gas Bills to be promoted next session will have informed readers as to the smallness of their number. But though their number is not large—under twenty, in fact, including local authority "Omnibus" Bills with a few ordinary gas clauses in them—their examination for feature and novelty cannot be any the less critical. The group that is dealt with elsewhere to-day comprises Companies who have been working under Provisional Orders, and are now going to Parliament direct for the first time, and new Companies proposing to open up fresh ground and enterprise. Looking at these Bills, and glancing cursorily through those yet to be investigated more closely, there appears to be little about them, if we except the Kingston-upon-Hull Bill, that will give rise to anything of a sensational nature. We say "appears to be;" as, forsooth, in these days it does not do to speak beforehand of parliamentary matters too assertively. The intervention of local authorities has sometimes the effect of creating all sorts of unhappy issues and positions.

In this first group of Bills, however, we do not see anything on the surface that should foment discussion in the Committee-Rooms, unless it be in the matter of the amount of capital sought, and the standard prices asked for; and differences in these respects can, as a rule, be promptly settled without asking for a decision from a Select Committee. Regarding the amounts of capital entered in the Bills, in most instances they are of modest amount. The largest augmentation is sought by the Grays and Tilbury Company; out of a total of £200,000, asked for in the Bill, £136,000 being additional, besides the customary one-third borrowing powers. Altogether the total capital required by these Companies, including that already spent and the borrowing powers requested, is close upon £500,000. The standard prices are all very close—gravitating between 4s. 3d. and 5s. The Annfield Plain Company is the lowest with 4s. 3d. Four Companies ask for 5s.; and two of them are the Bude and Brockenhurst Companies, whose Bills in detail are as much alike as two peas. Among special interesting points, the Boston Spa Company are seeking authority to supply certain districts left derelict by another Company having power of supply over them; and in the case of the Selsey Company, they are proposing to lop their district off that of the Petersfield Gas Company. The Boston Spa Company also submit the reasonableness of creating and distributing among the present shareholders £2000 that has been spent out of profits on the works.

There is strict compliance, in all the eight Bills in this group, with the model clauses in specifying an illuminating power of 14 candles; but promoters should not overlook the fact that certain Companies last session were authorized to supply 13-candle gas. Concerning the methods of testing the gas, it is difficult to see why the model clause has not been adhered to in all cases, in view of the advantage that it offers to gas undertakings by treating the gas in a manner to obtain from it the best possible result when burned at the fixed 5 cubic feet rate. The Annfield and the Llandrindod Wells Gas Bills prescribe the "Metropolitan" argand burner No. 2, a bar photometer, and the Harcourt 10-candle pentane lamp. The Shanklin Company do the same; but they propose to secure the option of using either the bar or the table photometer. We do not think they will trouble themselves over the latter. The Grays Company specify the table photometer, and not the bar. The Boston Spa Company merely define the Metropolitan No. 2 burner, and say nothing about the standard of light or the photometer. But there are three Bills, under the charge of one firm of Parliamentary Agents—the Brockenhurst, the Bude, and the Selsey—the draftsman or draftsmen of which have apparently not heard of the new testing arrangements, and the model clause specifying them, for in all three Bills, for 14-candle gas, Sugg's "London" argand No. 1 is specified!

Touching upon this particular question of testing, it is rather astonishing that a precedent created last session by the South Suburban Gas Company's Act—that is to say, a precedent for Companies outside the Metropolitan area—has not been seized upon by promoters to a larger extent. It is feared that, notwithstanding the prominence that was given to the matter and its importance, it has been overlooked. There are two new Companies, however, who are proposing to take advantage of the provision; and these are the Annfield Plain and Llandrindod Wells Companies. The clause is worded the same in both Companies' Bills; and it may be quoted in order to emphasize it:—

> If the illuminating power of gas supplied by the Company shall be below the prescribed number of candles to an extent not exceeding half-a-candle, the Company shall not be liable to any penalty in respect of such deficiency; and if such illuminating power shall be below such prescribed number of candles to an extent exceeding half-a-candle, but not exceeding one candle, the penalty to which the Company shall be liable in respect of such deficiency shall be not exceeding £5.

We are anticipating that it will be found that the same hand has caused the insertion of this clause in both Bills, and that that same hand has connection with the directorate of the South Suburban Company.

A most interesting feature about these Bills has reference to the question of discounts. In several of the Bills, advantage has been taken of the intimation made in the Model Bill, that the discount-limiting clause is not required if section 13 of the Gas-Works Clauses Act, 1847, is amended by appending these words: "Provided also that every such "contract entered into by the company shall be alike in "terms and amount under like circumstances to all consu-"mers." This amplification of the section in question is made, in certain of the Bills, in the clause incorporating by reference the Gas-Works Clauses Acts; and, excepting in a couple of these instances, no clause appears defining maximum discounts. We cannot conceive why in these cases, under the circumstances, the superfluous discounts clause appears. There is the Shanklin Bill, for example. In the forepart the way provided by the authorities for immunity from the restricting rebate condition for large consumption is properly applied; but later in the Bill stands the old clause defining a maximum of 10 per cent. for prompt payment and 15 per cent. for large consumption. Why? Then in the Grays and Tilbury Bill, there is a clause that seems to require some explanation or alteration. The amendment of section 13 of the Gas-Works Clauses Act, 1847, is duly made; then later on prompt payment is limited to 10 per cent. There is nothing to complain of about that, as 10 per cent. for prompt payment is not the objectionable feature of the discounts clause. But there appears this subsidiary passage of somewhat cryptic meaning: "Pro-"vided also that, in the event of a discount given under "the provisions of this section being made of an equal "amount applicable alike, without regard to the circum-"stances of the consumption, to all consumers of gas by "means of ordinary meters, the standard price, for the pur-"poses of this Act, shall be *the price charged to such consumers, "less the said discount.*" Now, what is the literal interpretation of this? The standard price in the Bill is 5s. But this provision, if it means anything at all, means that whatever the charge to the consumers, that charge, less the uniform discount to all consumers, shall be the standard price. This would hardly meet the views of the shareholders. We rather fancy that what is intended is that, if a uniform discount is allowed, then that discount shall be regarded as a reduction for the purposes of the sliding-scale. We may be wrong; but, to say the least, the latter part of the passage in question does not appeal to us as a pattern for lucidity.

Those Limited Companies who are among the promoters in the group of Bills under notice will be interested in an announcement that we make elsewhere, that definite steps have now been taken to test the claim of the Inland Revenue Commissioners for stamp duty, on the vesting of the property of the Limited Company in the statutory one. It is a matter that we strongly commend to the consideration of such promoters; for it would be well, now that a movement has been made, to get the uncertainty that at present exists cleared up once and for all.

Electricity Consumers and Supply Failures.

IT is not our intention to gloat over the misfortunes of the electrical competitors of the gas industry; but however benevolent one may feel, the many contingencies besetting constancy of electricity supply cannot be bye-passed in the rivalry for business. At the same time, we are not disposed to agree with those who hold that "all is fair in love and "war;" but it may be submitted that all is fair in business rivalry that is consonant with fact. Therefore, we shall not be charged with taking any mean advantage in again referring to two recent important failures of electricity supply in London. Nor need it be feared that we shall be charged

with discourtesy in mentioning the fact that those of our electrical contemporaries perused by us last week gave a modicum of space to their references to the extinction of the electric light in Oxford Street one evening while Christmas shopping was at its full height, and as little as possible was said about the disaster in the South Metropolitan Electric Light and Power Company's district. These two accidents could not have occurred at a worse time, both for the suppliers of electricity and particularly for the consumers. It is during the long-hour lighting days that the tradesmen very properly hope to reap the best harvest of the year; and therefore that is the period during which they can least of all afford to be deprived of light. In the one case, the light failed in the large shops of Oxford Street just at the time when they were packed with customers; in the other, owing to the bursting of a boiler, supply was suddenly cut off throughout large and thickly-populated south-eastern districts. Through the busiest part of the Christmas shopping, the tradesmen in the latter areas who had gone over to electricity, and during the festive season those householders who had had the gas-fittings removed from their rooms, were put to their wits' end to get sufficient light by which on the one hand to do business and on the other to entertain their friends and enjoy themselves. However melancholy the accident, however deep the sympathy of consumers, and however greatly they may strive to feel at peace with the whole world and show goodwill to all men, it is hard for them, at such a time and under such conditions, to philosophically resign themselves to the inconvenience and the discomfort of being without their usual means of artificial illumination, and to feel graciously indulgent.

From the business point of view, the southern accident was—we agree with an electrical contemporary—a serious matter for the South Metropolitan Electric Supply Company. Not only did they lose business at an important time, but confidence has been lost and business has taken a short cut to a more dependable quarter. Consumers cannot be expected to retain confidence when they learn from the Chairman of the Marylebone Electricity Committee that even a "flash-over" on one of the big machines—a trouble to which, he admits, "electric plants are very liable"—will cause failure, as it did cause it in Oxford Street, of the electric supply. It is foolish of the electrical press to attempt to minimize the length of time that the consumers in the South Metropolitan Electric Supply Company's district (excepting in that portion served from the small Sydenham station) have been without a supply. It was fortunate that the Company had purchased those works at Sydenham; as the maintenance of the supply in this residential corner of their district from that small station put a better appearance on the breakdown in the eyes of the outer world than people within the other parts of the extensive area know only too well the conditions warranted. The fact is that the whole of the electricity consumers who are not in the old district of the defunct Crystal Palace Supply Company, suffered more or less through the catastrophe; and all would have been deprived of supply if the Sydenham station had not been purchased. However, "it's an ill-wind that blows nobody good." Directly consumers, especially shopkeepers, in the huge district found that it was not one of those temporary failures to which patient electricity consumers become familiar, and are not unacquainted with in the Company's area of supply, the South Metropolitan Gas Company's fitters were anxiously requisitioned to bring relief, and, in many a shop and in many a house before Christmas, the reliable gaslight was restored, to the delight of those stranded electricity consumers who were fortunate enough to be among those who first sought succour of the Gas Company (whose chemical works, by the way, received damage from the explosion). This disaster has come perhaps somewhat opportunely for London. It raises once again the question as to the policy of putting all one's eggs in one basket. Although centralization in the generation of electricity may assist in whittling down costs, cheapness is not the only consideration when so much beyond the generating-station depends on the constancy of supply.

A Vigilant Ratepayers' Association.

If ever the ratepayers of Newport (Mon.) become overburdened by the "progressiveness" of the Corporation, it will not be because they are kept in ignorance of the financial position of the several undertakings which are in the hands of that body. Their information will not, however, come from an examination of the municipal accounts, because, as presented, they will probably not be understandable by the ordinary ratepayer, but from the light thrown upon them by the vigilant Ratepayers' Association which is in existence in the borough, the Committee of which includes the Secretary of the Gas Company (Mr. T. H. Hazell) and representatives of the Chamber of Commerce and the principal trade organizations. The latest instance of the Association's watchfulness over the interests of the ratepayers is to be found in a circular the Committee have issued dealing with the accounts of the electricity works and the tramways for the year ending March 31, 1906, which have lately been published; thus completing their review of all the municipal accounts for the last financial year. The value of the criticism contained in the circular is shown by the fact that at a recent by-election a statement was made that the two undertakings dealt with "had not cost the town a single penny," and the speaker did not think they ever would. No doubt those who listened to the speech containing these remarks went away perfectly satisfied that they were justified. But the Committee's circular shows clearly that they are absolutely inaccurate; for in the four years 1897 to 1902, the direct contributions to the undertakings out of the rates amounted to £3863. These transfers were made without any concealment. But other amounts were directly contributed in a very different way, as the Committee point out. Then there have been indirect contributions—such as the use, without charge, of the various staffs for the purpose of the undertakings. The market accounts furnish an example of this in connection with the lighting; and the Committee cannot help coming to the conclusion that in every case where the electric light has superseded gas for municipal purposes, there is *primâ facie* ground for assuming that an indirect contribution is being made out of the rates towards the Corporation undertakings. We cannot go into the details covered by the Committee's circular. Suffice it to say that, after three years' working, not a penny has been set aside to meet renewals, and the two undertakings are £2998 to the bad. Consequently, these particular examples of Corporation enterprise do not merit the eulogy which is continually heard in regard to them, a specimen of which was quoted in the early part of these remarks; and, judging from the statements in the circular, those who indulge in it are diverting the attention of the ratepayers from the real position. This, however, is occasionally made apparent in a way that is possibly not intended. It appears that there is under consideration the question of supplying electricity to the docks; and it has been stated that, if the matter went through, "it would be the salvation of the borough electricity concern." Although, according to one speaker, the undertaking has "not cost the town a single penny," and is not likely to do so, another considers its condition to be so serious as to need salvation. The latter view seems to us to more correctly represent the facts as disclosed by the circular under notice.

The Gas Supply of Paris.

It will doubtless be remembered that the Municipal Council of Paris, at their meeting on the 3rd ult., decided, by a majority of only one, to have the gas supply of the city carried on under a concession, and to terminate the temporary joint arrangement between the Municipality and the Liquidators of the Paris Gas Company at the close of the year. In virtue of this decision, offers were invited, to be sent in by the 15th ult.; and a representative Committee, with the Prefect of the Seine as President, was appointed to examine the proposals submitted. It appears that about twenty have been received; four or five of them emanating from parties who are evidently serious in their desire to obtain the concession on the terms laid down by the Prefect, with certain more or less important amendments. Since these were prepared, it has been decided to allow 4 per cent. instead of 3 per cent. as the minimum return on the capital invested. Interviews have taken place between representatives of concessionary undertakings and the Streets Committee of the Council, as there was little time to lose, in view of the vote to break off with the Gas Company at the end of the month just closed. But a few days ago there seemed to be a probability of the existing provisional joint arrangement being continued for another year.

The Midland Junior Gas Engineering Association will meet at the City of Birmingham Technical School, Suffolk Street, next Saturday, when Mr. R. J. Rogers will read a paper entitled "Notes on Distribution and Gas Supply."

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 49.)

THE Stock Exchange has just completed a disjointed and not an altogether happy week. The holidays cut out the middle, and perhaps the most important, part of it. On the opening day, things were in a state of high tension over a heavy American account which had to be settled in spite of stiff rates of contango. On the re-opening on Thursday, that market was still much agitated, but eventually it was believed that more or less satisfactory arrangements had been effected. In other lines the tone was far more favourable; and the anticipation of monetary conditions being better, produced a good feeling. In the Money Market, there was a very strong demand on account of the Stock Exchange and the close of the year; and rates for short loans hardened accordingly. But for discount, especially for long dates, rates were easier. Business in the Gas Market was naturally quiet; and it was almost wholly devoid of feature. There was hardly any variation in prices; and the very few changes in quotation that were made were almost infinitesimal. In Gaslight and Coke issues, the ordinary was a little dealt in at good, steady figures, the range of prices being from 98¾ to 99½. In the secured issues, there was no business done, except one deal in the preference at 108¾. South Metropolitan, though little noticed, did not suffer from the lack of support—transactions being marked at 129, and 129½. Nothing at all was done in Commercials. In the Suburban and Provincial group, Alliance old was done at 20⅞, Brighton original at 233½, ditto ordinary at 165, British at 42⅝, and West Ham at 102½. In the Continental Companies, Imperial changed hands at from 178½ to 177, the last mark being the lowest, and ditto debenture at 96¼. European fully-paid was done at 24⅞, and Union was not dealt in. Among the undertakings of the remoter world, Melbourne 4½ per cent. was done at 102, Primitiva at 7½, and River Plate debenture at 98.

The closing prices are shown in our Stock and Share List on page 49.

According to usual custom, we append a table showing the closing prices at the end of 1905 and those of 1906, with the respective gains and losses in value. The general firmness of gas securities as an investment market is well illustrated by the inconsiderable magnitude of these variations. The fact that the greater number are in the downward direction requires no explanation, when almost everyone is acutely aware of the depression existing in even the most gilt-edged markets, and of the unprecedented state of disorganization that is oppressing our Money Market. At this time last year, we said that the gas industry appeared to be in a decidedly healthy state; and we say the same again now.

GAS COMPANIES.	Prices on Dec. 30, 1905.	Prices on Dec. 30, 1906.	Gain or Loss.
Alliance and Dublin, 10 per cent.	20—21	20—21	—
Do. 7 per cent.	14½—15½	14—15	−½
Bombay, Limited	6¾—7¼	6½—7	−¾
Do. New, £4 paid	5—5½	5—5½	—
Bournemouth, 10 per cent.	29—30	28—29	−1
Do. B. 7 per cent.	17—18	17—17½	−½
Do. Preference 6 per cent.	15½—16½	15—16	−½
Brentford, Consolidated	260—265	260—265	—
Do. New	197—202	200—205	+3
Do. 5 per cent. Preference	125—130	120—125	−5
Do. 4 per cent. Debenture Stock	101—104	101—104	—
Brighton and Hove, Original	222—227	230—235	+8
Do. A Ordinary Stock	162—167	163—168	+1
British	42½—43½	41—43	−1
Bromley, Ordinary 5 per cent. A.	121—124	121—125	+½
Do. 3½ per cent. B.	91—94	91—94	—
Buenos Ayres (New), Limited	12¼—12¾	11¾—12	−¾
Do. 4 per cent. Debenture	95—97	94—96	−1
Cagliari, Limited	24—26	24—26	—
Cape Town and District, Limited	17—17½	14—15	−2½
Do. 4½ per cent. Preference	10—10⅝	9¾—10	−⅝
Do. 6 per cent. 1st Mort.	52—54	50—52	−2
Do. 4½ per cent. Deb. Stock	100—102	96—98	−4
Chester 5 per cent. Ordinary	..	108½—110½	—
Commercial, 4 per cent. Stock	116—118	110—113	−5½
Do. 3½ per cent. do.	112—114	107—110	−4½
Do. 3 per cent. Debenture Stock	84—86	83—85	−1
Continental Union, Limited	126—129	124—127	−2
Do. 7 per cent. Preference	143—148	138—143	−5
Derby, Consolidated Stock	125—127	122—124	−3
„ Debenture Stock	108—110	105—107	−3
European, Limited	22—23	24½—25½	+2½
Do. £7 10s. paid	15—16	18—19	+3
Gaslight and Coke, 4 per cent. Ordinary	102—103	98¾—99½	−3½
Do. 3½ per cent. maximum	89—91	88—90	−1
Do. 4 per cent. Con. Pref.	110—112	107—110	−2½
Do. 3 per cent. Con. Deb.	86—88	84—86	−2
Hastings and St. Leonards, 3½ per cent.	101—103	98—103	−1½
Do. 5 per cent.	..	118—121	—
Hong Kong and China, Limited	19½—20½	19½—20½	—
Imperial Continental	233—235	177—180	..S'tk Con.
Do. 3½ per cent. Deb. Red.	96—98	95—97	−1
Lea Bridge Ordinary, 5 per cent.	118—123	120—125	+2
Liverpool United A	237—239	229—231	−8
Do. B	172—174	167½—168½	−5
Do. Deb. Stock	109—111	110—112	+1
Maidstone, 5 per cent.	..	145—150	—
Malta and Mediterranean, Limited	4⅛—4⅜	4⅛—4⅜	—
Metropolitan of Melbourne, 5 p. c. Deb.	100—102	101—103	+1
Do. Do. 4½ p. c. Deb.	100—102	101—103	+1
Monte Video, Limited	11½—12½	11½—12½	—
Newcastle and Gateshead, Consolidated	107—109	111½—112½	+4
Do. 3½ p. c. Deb. Stk.	98—100	98—99	−½
North Middlesex, 10 per cent.	18½—19½	20—21	+1½
Do. 7 per cent.	13—14	13½—14½	+½
Oriental, Limited	148—151	150—155	+3
Ottoman, Limited	6—6½	5⅝—6¼	−¼
Primitiva, Ordinary	7—7⅛	7⅛—7⅜	+¼
Do. 5 per cent. Preference	5⅛—5⅜	5⅛—5⅜	+⅛
Do. 4 per cent. Deb. Stock	97—99	94—96	−3
River Plate, Ordinary	12¾—13⅛	12¼—12⅝	−⅜
Do. 4 per cent. Deb. Stock	95—97	95—97	—
San Paulo, Limited	13—13⅛	13¼—13⅜	+¼
Do. 5 per cent. Deb. Stock	51—53	49—51	−2
Sheffield, A.	244—246	246—248	+2
Do. B.	244—246	246—248	+2
Do. C.	244—246	246—248	+2
South African	15⅛—16⅛	15⅛—16⅛	—
South Metropolitan, 4 per cent., Ordinary	132—134	128—130	−4
Do. 3 per cent., Deb. Stk.	87—89	85—87	−2
South Shields Consolidated Stock	..	156—158	—
South Suburban, Ordinary 5 per cent. Stk.	123—126	123—126	—
Do. 5 per cent. Preference Stk.	125—130	123—126	−3
Do. 5 per cent. Debenture Stk.	132—137	128—133	−4
Southampton, Ordinary	109—112	105—110	−3
Tottenham and Edmonton, A 5 per cent.	125—128	127—130	+2
Do. B 3½ per cent.	99—102	104—106	+4½
Do. 4 p.c. Deb. Stk.	105—107	101—103	−4
Tuscan, Limited	9⅝—10	10½—11	+1
Do. 5 per cent. Deb. Red.	100—102	101—106	+4
Tynemouth, 5 per cent. maximum	..	106—108	—
Wandsworth and Putney, B 3½ per cent.	137—140	140—145	+4
Do. C 3½ per cent.	113—116	113—116	—
Do. 3 p.c. Deb. Stk.	80—83	79—82	−1
West Ham, 5 per cent. Ordinary	106—108	102—104	−4
Do. 5 per cent. Preference	123—126	120—123	−3
Do. 4 per cent. Debenture Stock	102—107	101—104	−2

PERSONAL.

Mr. B. A. LEWIS, of Carmarthen, was on the 18th ult. installed W.M. of St. Peter's Freemasons' Lodge, No. 476.

Mr. E. H. SCOTT, Assistant-Chemist to the Priestman Collieries, Limited, Blaydon-on-Tyne, has, from a number of candidates, been successful in obtaining the position of Chemist to the Manvers Main Collieries, Limited, Wath-upon-Dearne.

OBITUARY.

Mr. JOHN W. BLACK, Gas Manager at Para, Brazil, recently succumbed to an attack of fever; Mrs. Black having died a few days previously. For several years before 1902, Mr. Black was Gas Manager at Stewarton, in Ayrshire. He was a native of Leith.

There has recently passed away at Fallbrook, San Diego County, California, at the advanced age of 80, Mr. THOMAS SMITH, a gentleman whose name will always be associated with the gas supply of Hereford. He was born at Tooting in 1826, and went to Hereford in 1855. He had not been long resident there before he brought himself into public notice by his letters to the local newspaper on various subjects; among them being the price and quality of the gas. These letters led to the holding of a public meeting at which the well-known Mr. George Flintoff delivered a lecture. This induced the Town Council to enter into negotiations with the Gas Company for the sale of their works, which could at that time have been purchased for some £16,000 or £18,000. The Engineer appointed by the Company (the late Mr. Thomas Greaves Barlow) declined to meet Mr. Flintoff, who was engaged by the Council to act for them; and those who took the lead in the negotiations let the matter drop. It was taken up again later, and the works eventually acquired in 1872.

We regret to record the death, on the 21st ult., in his 60th year, of Mr. JAMES HENRY PARSONS, the Manager of the Oswestry Gas-Works. He had not been in good health for some time; but it was not until a week before his death that he found it necessary to keep his room; and he succumbed to an internal complaint. His connection with the Oswestry Gas Company began in 1876, when it was not in anything like its present prosperous condition. He, however, immediately commenced a series of improvements in the works, which in the course of time completely transformed them. As a designer of gas-works he enjoyed a well-deserved reputation; those at Barmouth and Buckley having been built from his plans and under his supervision. He was also Consulting Engineer for a number of gas undertakings in various parts of the country. For about three years he was Secretary of the Company in whose service he died. He was a prominent Freemason, and several times held office in Provincial Grand Lodge. He is survived by his wife, four sons, and four daughters. The funeral took place on Monday of last week, at the Oswestry General Cemetery. The death of Mr. Parsons is the second loss the Company have sustained; the Chairman, Mr. F. B. OWEN, having lately passed away.

Wit.—In the "Pall Mall Gazette" last Saturday, this little piece of humorous writing was found: "How few of our readers will remember, and how many more will be surprised to be told, that it is only a quarter-of-a-century ago to-day since a London theatre was first lighted by electricity—the Savoy? Things move so rapidly that we are beginning to forget gas lighting as a survival from the dark ages, though gas is still useful in heating and cooking."

ELECTRIC LIGHTING MEMORANDA.

A Review of the Past Year.

SCRUTINIZING affairs of the electrical industry from the standpoint of representatives of a competing industry, and having regard only to those matters where the two come into conflict, it must be said that the past year has been full of interest, with moderately exciting events interspersed here and there. When we sum up the current relative positions of the two industries so far as they affect and bring influence to bear one upon the other, those engaged in the gas industry have no cause for discomposure, but every ground for satisfaction. The electrical industry has by no means stood still; but the greatest successes have been in connection with traction, with which we have no particular concern. In other respects, things have not gone so well with the industry as those engaged in it could wish. In electric lamp manufacture, there has been progress; but a large amount of indefiniteness and imperfection exists. Cooking and heating by electricity are not making any considerable headway; and electric prepayment meters do not appear to be gaining confidence and patronage. In industrial power supply, there are certain purposes for which electricity is particularly convenient, though somewhat costly, and yet not, as prices go, altogether remunerative for the purveyor of electricity; but those special purposes do not, to the regret of electricians, comprehend the whole. Accounts published during the year have shown that profits have, in many cases, diminished through reduced prices accompanied by higher working expenses; and for municipal undertakings loans are not easily obtained at moderate rates of interest. Copper, too, has gone up by leaps and bounds; and expenditure for new work and extensions has been on the up-grade. Electric plant manufacturing concerns are, so far as profit producing goes, still under a cloud. So altogether the position for the electricity industry is not one to cause any great amount of exhilaration. Sham optimism has been largely on the surface of affairs electrical during the year; and the vials of wrath and abuse have been running over—and copiously. The stock statements as to the poisonous character of legitimately used gas, which has never been known to poison anyone throughout upwards of a century, when so used, have been poured out in volumes at intervals in the hope of deluding the credulous. But the behaviour of the men who engage in this is not exactly heroic. They attack by word, but refuse to subtantiate by deed. Take two examples from many. There was the prize essay published by the Electrical Contractors' Association. The criticism of that essay was received without a note of response. At Ipswich, some most extravagant statements were published by the Corporation Electricity Department as to the relative cost of gas and electricity; but a challenge by Mr. L'ce Fletcher, on behalf of the Welsbach Company, to support statement by demonstration, was received with cold silence. There has been less heard about relative costs in the course of the year. The electricians have ascertained how hard it is to kick against the pricks. It is found by consumers, when their accounts are delivered, that their custom has been obtained under false pretences as to cost; and there is no argument in the world that is so forcible as that of the pocket.

The strenuous exertions that have been made during the year by electrical undertakings to secure business have been convincing of the recognition by them of the fact that they must be up and doing. Development is a slow process without particularly propitious circumstances, or the fullest application of careful encouragement. Literature, in the shape of "Electrical Bulletins" and circulars, has been freely distributed; and mendacious posters have claimed public attention. Canvassing and exhibitions have been resorted to; builders have been tempted to have houses wired; and wiring and fitting systems have been further tried. There is not the slightest distress in the gas industry over all the commercial activity the electrical industry can bring to bear, nor over statements of real fact; but there must be protest when there is the gross perversion that has been too plainly in evidence in recent times. Among the methods that were proposed to induce new custom was that of the Dublin Corporation, of giving new consumers a six months' run at half price; but we did not hear whether this, what appeared to be a piece of illegality, was proceeded with, and, if so, what was its effect. Several new systems of charging were added to the already long list of complicated methods to which the electrical industry has given birth in the endeavour to gain new custom. The old order of a flat-price, with discounts according to consumption, is not good enough for the managers of the electrical industry; but consumers in many places have been clamouring for its restoration. The system on which their fathers bought, and on which all other industries sell, is good enough for them. The maximum demand system has fallen into further disrepute—notably, among other places, at Brighton. There has been a great discussion during the year as to the charges for power and for cooking and heating. Many undertakings have rashly dropped to 1d. per unit as a maximum for these purposes. And in connection with the 1d. and fractions of 1d. for power purposes, there has been a great babbling about prices being calculated upon the provision the undertakers have to make for the purpose of meeting the maximum demand of the consumer. Rather a hazy kind of thing upon which to make a definite calculation as to a paying price for a consumer whose success or otherwise (which depends upon many factors) in business will control his consumption! If this system of calculation is applied to the power user, and it works out honestly to the other consumers, why is it not applied to cooking and heating and lighting? If 1d. is fair for a power user, it must be too low for current used for such a comparatively small and intermittent purpose as cooking. And if 1d. is right for cooking, a price much lower than that ought to be charged the public for street lighting. The more the matter is argued, the more absurd the wide differential prices of the electrical industry are shown to be, and the more clear is the injustice of the bottom-prices to the users for lighting purposes. Consumers are beginning to argue these things among themselves, and are getting dissatisfied. About the 1d. per unit for power purposes, the Liverpool Electrical Engineer has said that it has failed in that industrial city to attract long-hour users; and that it is unremunerative for short-hour ones. Messrs. Bowden and Tait, in the "Electrical Review," Mr. George Wilkinson, and Mr. W. B. Esson have, in the course of the year, also pricked the bubble of a 1d. being a profitable maximum rate for power. Then connected with charges are meters. Their erratic character in respect of veracious registration has been disclosed during the year by a report of the Highways Committee of the London County Council and by correspondence in one of our electrical contemporaries. There was, a few weeks since, an amusing case in the City of London Court, for the recovery of money, in which case it was shown that an electricity meter had been diligently prosecuting its business when no current was passing through it. Prepayment meters, on account of cost, complication, unreliability, and a disinclination on the part of the working class to have anything to do with them, have not made headway.

In the lighting field, flame arc lamps and the new metallic filament lamps have almost monopolized attention. It seems to be admitted that the ordinary arc lamp and the carbon filament lamp have reached the zenith of possible improvement, and that they cannot be relied upon to do anything important now in advancing the interests of the electrical industry, with incandescent gas lighting standing in the way. What the electrical industry has now to secure are lamps of greater efficiency in relation to consumption, less costly in running, less expensive initially, more reliable, less unsteady, and not subject to such great depreciation as are electric lamps of the present. In the flame arc lamps, or in the new metallic filament lamps, it cannot yet be said that anything, excepting enhanced efficiency in relation to the consumption, has been accomplished. With regard to the metallic filament lamps, they have such great likes and dislikes in reference to the conditions of their use, that hopefulness is not all at a high level in the electrical world as to their future success. The tantalum lamps decline to do efficient service with alternating current; the Nernst lamp is discontented with voltages below 200; and most of the other lamps require such low voltages that they must be used in series, or "brief life is here their portion." This necessity for use in series will, from the consumers' point of view, wipe out all the promised money advantage of lower consumptions and higher efficiencies. By some electricians this is looked upon as beneficial rather than otherwise; for the bare idea of assisting consumers to economize consumption, when they are now on their own account economizing all too seriously, has been rather disconcerting to some engineers. We do not agree with them, but have not time to argue the matter again at present. However, the attempt to perfect these metallic filament lamps is proceeding with great activity; and something good may be produced later on. Meanwhile, consumers continue to be implored to spend money on renewing their carbon filament lamps more frequently, in order to save money on consumption. Consumers are supine, grumbles the electrical engineer; and Mr. Fedden, of Sheffield, and the Ediswan Company have been telling the electrical engineer to convey to consumers the intelligence that carbon filament lamps should be renewed two or three times a year—in other words, they should spend 2s. to 3s. per point per annum on renewals. Consumers with a large number of points of lighting wonder whether the expenditure is really compensated for by the extra candle power obtained. Manufacturers of these lamps have also been severely "slated" for not producing lamps of more uniform character and of greater lasting power. They, in turn, have advised station engineers to look after their voltages, the variability of which is the cause of much annoyance through the depreciation of illuminating powers. Mr. Leon Gaster and Mr. G. Wilkinson are among those who have been addressing electricians on this subject of variable voltages during the year. There was a case in which Messrs. Mappin and Webb were lately concerned, in which the firm complained that they had to use candles in their West-end house owing to the departure of the Marylebone Borough Council from their contract voltage.

Street lighting has been a prolific subject of controversy, from which gas, as an economical public agent, has come out best. The City authorities have shown that the estimated savings in the lighting of the streets whence electricity has been evicted have been exceeded. In several places gas has scored further prominent successes. Among those specially noted during the year were Wellingborough, Coatbridge, Paliament Street and Whitehall, Vauxhall Bridge, and the new Victoria Railway Station. These are only examples of many. At Hastings controversy ran high, owing to the heavy expense that electric lighting has entailed through Corporation management (or mismanagement) of the electric undertaking. In this instance, the Corporation brought

upon themselves the ridicule of the ratepayers of the town, and of many other people who are not Hastings ratepayers. But Hastings is only an example of a great many other places where electric street lighting is favoured merely for the purpose of giving business to the Corporation electricity department. The Local Government Board have at Newcastle, Bridlington, and several other towns, through Mr. H. R. Hooper and Mr. R. H. Bucknill, given expression to their conviction that electric street lighting is much heavier in cost than an efficient system of incandescent gas lighting. There is substantial ground of complaint as to the preferential treatment that local authorities accord to their own electricity supply, instead of dealing with it as an independent branch of civic administration, and causing it to compete with gas on its merits. There was the Oxford Street scandal for example, in which the Lighting Committee, for stated and positive reasons, recommended incandescent gas lighting; and then, on opposition being raised by the electrical advocates, they veered round to electricity. Their original strong report favourable to incandescent gas lighting is on record. Further amusement has been caused by the continued efforts of electricians to turn the scale in favour of electricity by rubbing into town councillors the cost per candle power per annum, instead of tackling the more practical basis of the cost per mile of street lighting per annum. Figures as to the costs per mile are to be found in the "JOURNAL" for Oct. 30 and Dec. 18. Professor Silvanus Thompson gave before the British Association some useful comparisons of the costs of artificial illuminants, and which comparisons were dealt with in our issue for Aug. 14 last. The year also produced evidence that flame arc lamps are not appreciated in America; and it also yielded plenty of testimony concerning the tyranny of municipal authorities in compelling support of electricity undertakings through the public lighting, while it has gone forth from the "Electrician" that the "great majority" of streets can be sufficiently illuminated by incandescent gas-lamps. Of course, we think that all streets can be.

Enough has been said in the opening paragraph about the insignificant progress of cooking and heating by electricity; but on the use of electricity for industrial purposes, there is a little to be said. The large power companies are not—save perhaps one or two specially favoured concerns—finding that their clouds have any particularly nice silver linings; and users of electricity motors are becoming painfully aware that with this form of energy they are dealing with an uncertain quantity. One in eight was the proportion of motors that broke down in 1905 in the case of those insured in the British Engine, Boiler, and Electrical Insurance Company. Stoppage of supply, resulting in very considerable loss to a firm at Loughborough, was the subject of an action during the year; and the cycle and motor establishments at Coventry have had their output restricted owing to the failure of the Electricity Department to give a constant supply of electricity. The Local Government Board have reduced the period for the repayment of loans for motors; so that their experience of them does not justify long loan-periods. It came out, too, in an inquiry at Brighton, that the Corporation had had to spend £250 on the maintenance of motors which only brought in £573.

Speaking of failures reminds of the numerous occasions we have had during the year to chronicle the failure of electric lighting—in private houses, in churches, in shops, and in the streets. Two prominent incidents were those of Oxford Street, and in a large area of the South Metropolitan Electric Supply Company, just when Christmas shopping was in full swing. Accidents and fires due to electricity have been many during the year. According to figures in a report issued by the London County Council, it was ascertained that the ratio of fires to consumers in the case of gas in London was 1 in 2000; while that of those caused by electricity was 1 in 1000. It was reported in the City that twelve fires were caused by electricity in 1904, and a smaller number in 1905—Dr. Waldo, the City Coroner, giving it as his opinion that more accidents of the kind happened than come to light. Heavy damage was caused to the Italian and Hungarian Decorative Art Section of the Milan Exhibition—the outbreak being due, said a telegram published in this country, to the fusing of an electric wire. In South London, damage to the estimated value of £30,000 was done to a drapery establishment owing to fire started by inflammable material coming in contact with an electric lamp. At Derby, a man was killed under peculiar conditions by a voltage of only 200. Fatal accidents at generating-stations were also recorded.

Interest in parliamentary matters during the session clung round the singular position created by the Government in connection with London schemes through the dominating municipal influence in its following. Everything was hung up to make a clear passage for the London County Council electricity scheme, which, after all, was not comprehensive enough for the broad-viewed legislators now in occupation of the House of Commons. The London County Council were given such encouragement that they have promoted an extraordinary Bill for the coming session, which, if Parliament does not pursue the same tactics as last year, will be opposed by privately promoted schemes of more rational character. The General Powers Bill of the London County Council was also passed with clauses giving powers to Borough Councils to supply wiring and fittings to houses; but there is a proviso that the wiring and fitting business is to be carried on in such a manner that the revenue shall recoup the outlay. If a similar provision had attached to the wiring and fitting business of the West Bromwich and Kettering electricity undertakings, there would not have been the deficits that were reported during the year. While on this subject, it is convenient to say that the Electrical Contractors' Association continued their assault on municipal trading in wiring and fittings. The Brighton Corporation, after investigation, came to the conclusion that there was nothing in the business worth troubling over. Sir Alexander Kennedy has advised the Woolwich Borough Council that money can be saved by abandoning their wiring department—a course that he has advised many other London and Provincial Councils to adopt. The question of electrolysis made no headway in Parliament, though Lord Newton suggested that the subject might well be inquired into by a Board of Trade Committee. The literature of the year dealing with the question indicated that the action of vagrant electric currents in many places is having a weakening effect on gas and water mains.

Municipal trading in electricity was vigorously assailed throughout the year. A series of articles in the "Standard" showed a scandalous waste in connection with public lighting, and studied deception in the manner of keeping the accounts of electricity undertakings, in diverting proper charges against undertakings to the general purposes funds, and in under-assessing concerns for rating purposes. What the "Standard" disclosed in connection with London applies to numerous concerns in the Provinces. Local Government Board inquiries revealed most disgraceful conditions of finance, and a defiance of the Board's authority. But the Board are determined to have straight accountancy; and a proper spending of loans on purposes for which they are specifically granted. Brighton and West Ham were notorious examples of financial mismanagement. Mr. John Burns early in his tenancy of office at the Local Government Board appointed a Committee to consider the general question of the keeping of municipal accounts. The Committee completed the taking of evidence last August; and an interim report is expected immediately after the holidays. However, it is the extravagance of the Progressive party that is at the bottom of deceitful accountancy; and at the last municipal elections, the ratepayers of London made nearly a clean sweep of the municipal extremists who have been the cause of the prodigality. In certain places, the sale of electricity undertakings to private companies was broached during the year; but in no case did the matter go beyond suggestion. Towards the close of the year, Sir Alexander Kennedy made a report upon the Woolwich Borough Council's electricity undertaking, in which he condemned, in the strongest possible terms, the wastefulness of the late Labour-Progressive Council. The undertaking, on which £250,000 has been spent, entails a heavy burden upon the rates. Sir Alexander advises the Council to consider the feasibility of taking a bulk supply from the South Metropolitan Company's electricity station before incurring further expenditure. Since then the Company's Greenwich station has not been in a position to supply even the ordinary consumers. Depreciation has had a prominent place in the electrical polemics of the year; and many municipalities have had lessons which have forced them to appreciate the wisdom of the policy of making provision in this way. Excellent reports on the subject have recently been made.

There is no occasion for further comment on these aspects of electricity supply as we find them at the end of another year. There are several clouds hanging over the industry; but, as competitors, we must not adopt a rest-and-be-thankful policy because, in comparison, our own outlook is so much brighter. The means of utilizing electricity for all purposes will be without any doubt further improved; and we must therefore do all possible betimes to maintain our lead.

Bench Lighting by Incandescent Burners.—In the abstract of the paper, on "The Lighting of Railway Premises," by Mr. Henry Fowler, of Derby, which appeared in the "JOURNAL" for the 18th ult., an example of bench lighting by an incandescent burner fitted with a special anti-vibrator was shown on p. 821. We are asked to mention that the appliance is one of those made by the Anti-Vibration Incandescent Lighting Company, Limited, and is covered by two patents. It is No. 760 in their list of burners, lamps, &c., suitable for factory lighting.

"Transactions" of the Societe Technique.—We have received the volume of proceedings of the Société Technique du Gaz en France for the past year. It contains the report of the thirty-third annual congress, held in Paris from the 19th to the 22nd of June, comprising the papers submitted and notes of the remarks to which they gave rise. Most of the papers, which are illustrated by diagrams, reproductions of photographs, and plates, have already been dealt with in the "JOURNAL." The introductory matter contains an illustrated description of the Versailles Gas-Works, which were visited by the members on the 21st of June; and in an appendix is described the electricity generating station of the Société d'Electricité de Paris, at St. Denis, which was inspected by them during the afternoon of the last day of the meeting. The other matter composing the volume consists of particulars with regard to the Society's prizes, lists of the companies contributing to the funds of the Society, the awards to employees, the rules, accounts, lists of officers and members, &c. M. Victor Delahaye reviews the legal business of the year 1904-5, and brings up to date his useful index to the cases contained in preceding volumes back to 1884. The book has been produced, as usual, under the supervision of M. Payet, the Secretary of the Society.

THE ILLUMINATION OF INTERIORS.

THE Illuminating Engineering Society (of America), formed less than twelve months ago, is likely to justify its existence by the character of the work it is doing. The Society has already established branches in New York, Chicago, New England, Pittsburg, and Philadelphia, and is following the excellent plan of having the same papers read and discussed at the various sectional meetings. The nature of the work—the study of illumination—makes the Society catholic in its membership, including gas engineers, electricians, and architects alike. The formation of such a Society in England has already been suggested; but the proposal was not taken up, probably due to the fact that most gas engineers, at any rate, have already as many technical meetings on hand as they can well attend. Incidentally, it may be suggested that there are many assistants in gas and electric works up and down the country whose duties lie to a great extent in the photometer-room and the laboratory; and they might well devote some part of their time to illumination, as distinct from mere candle-power problems.

The two papers—and particularly that of Mr. Woodwell—which are abstracted in another column from the November report of the American Illuminating Engineering Society, will amply indicate in which directions good work can be done. District superintendents also might help in this way, if only in the occasional publication of particulars of any good lighting scheme achieved, with diagrams of the disposition of lamps, and curves of foot-candle illumination obtained on the floors or working planes. As was suggested by one speaker in the discussion on these papers, for some time gas engineers have been striving to get the very most in candle power out of every cubic foot of gas; and it is now for those engaged in illumination work to see that the greatest effective duty is obtained from the candle power thus obtained. That the Illuminating Engineering Society—the title is not euphonious—are on the right lines to this end, is shown by the nature of the papers recently dealt with. Of the two papers on "Indoor illumination," by Mr. E. C. White and Mr. J. E. Woodwell, that of the latter is more comprehensive in character, and consequently of more general interest. The object of the paper is to outline the methods commonly employed in practical problems relating to the lighting of interiors; and this is considerably helped by descriptions and particulars of several concrete examples of illumination, thus illustrating the principles involved.

It is singular that both authors have something to say against the use of the ordinary polar diagram. In the one case, curves of uniform illumination are advanced as being more easily understood and applied; and in the other, the utility of the Rousseau diagram is preferably emphasized. Notwithstanding all that these gentlemen say, one cannot but think that, had these been the accepted diagrams and the familiar polar diagram brought forward for the first time, it would have been welcomed as being at once simple, graphic, and useful. It may be that it is liable to "mislead those unable to appreciate the actual phenomena which it represents;" but then the diagram is not intended for such people. The suggested possibility of misapprehension attaches with no less force to the substituted diagrams, which, indeed, presuppose a knowledge of the ordinary and more familiar curves. As Dr. Bell rightly says in the discussion, the ordinary polar diagram with a slide-rule is adequate for most purposes, and should present no great difficulty to anyone. This, perhaps, is beside the general purpose of the two papers; and it is to be said that the newer forms of diagrams merit some attention.

Mr. Woodwell's description of the Roussean curve will be read with interest by those unaccustomed to it. It shows proportionately the areas which gain or lose by the use of reflectors, and also the extent to which a small quantity of light borrowed from the horizontal zone may increase the intensity of light in a downward direction. This gain may, as Mr. Woodwell's diagrams indicate, be considerable; and where strong illumination is required for special purposes, the nature of the reflector—and, indeed, of all extraneous reflecting surfaces—becomes of considerable importance to the illuminating engineer in working out his scheme. The question of reflection is material, as Mr. Woodwell himself says, though, probably through the obvious limits of a paper, he does not deal with it to any great length.

It is possible that other papers may follow on this question, with diagrams both of the polar and Rousseau types, showing the influence of the character, tint, and shape of reflectors in increasing illumination in any particular direction. Reflection, because of its varied nature—direct, diffuse, and selective—offers a large field for discussion; and the evident regard paid by the authors to gains from this source, warranted a fuller treatment. One speaker points out the possibility of considerably increasing illumination by means of a reflecting surface of plaster of Paris. Any ordinary table of co-efficients of reflection will bear him out as to the possibilities of such adventitious aids, though so large a percentage gain as he has claimed is surely improbable. Some allowance must always be made for the comparative roughness and unevenness of the surface, its accumulating dirt, and discoloration. Mr. Woodwell, in referring to the gains due to diffuse reflection from walls, ceilings, &c., gives the formula $K = \frac{1}{1-C}$ (where C is the coefficient of reflection), as representing its value; stating that for large interiors this may lie somewhere between 1·25 and 1·50. If one is not mistaken, this gives C as high a value as 0·20 to 0·33 as the coefficient, which suggests in the case of large interiors, or halls, a very fair gain in illumination effect by the single means of reflection. The author does not give the factor for smaller rooms; but it may be taken that here the reflective effect would be much greater, especially in the case of light-coloured papers and white ceilings, the illumination being probably increased two or three times, as he suggests. This matter is of greater importance than the losses due to the obliquity of light rays with which Mr. Woodwell deals more fully. Dr. Bell deprecates the too frequent use of the cosine law in calculating the illumination effect, and rightly points out that oblique light is seldom used for reading or ordinary work, since one places a book or paper in such way as to use normal light rays. The paper includes full formulæ for ascertaining not merely the illumination due to oblique rays, but the accumulative effect of a number striking the same surface; the illumination due to oblique rays carrying the process to what would appear to be an unnecessary point of refinement, particularly in view of the slight treatment given to reflected light.

The subject of the intrinsic brilliancy of lights raises a question which should by degrees force itself to the notice of the thinking public. It is commendable that the members of the Illuminating Society have not lost sight of it. We are all becoming accustomed to higher grades of light brilliancy; and unfortunately, as Dr. Seabrook remarks, the tendency is to demand greater intensity as soon as the eyes become fatigued. What the effect will be in the future it is difficult (yet perhaps not difficult) to say, unless lighting engineers steadily seek to distribute light effectively—that is to say, where it is required, without necessarily having intense, and sometimes wastefully intense, sources of light. The general public requires high foot-candle illumination; and this is frequently achieved by the simple expedient of fixing a number of high-power arc or gas-lamps without regard to the effect of the brilliant points or surfaces of light upon the eyes. The problem lies before the lighting fraternity—that of getting good illumination without wasting the initial candle-power possibilities of the light. Shaded light-sources afford good means; but it cannot be, and is not, economical to produce powerful lights, and then tone down, or in other words partially destroy, their intrinsic brilliancy by opal or similarly heavy glass globes. Mr. Woodwell gives this as one alternative. The other is the location of the light-source out of the line of direct vision, securing the desired illumination partly by diffuse reflection.

The table of intrinsic brilliancies is useful; and it is interesting to know that the candle-power brilliancy per square inch of an incandescent gas-burner is lower, and therefore more in its favour, than that of any electric light in ordinary use. It is said that the Welsbach light has a brilliancy of from 20 to 25 candle power per square inch of surface, which is nearly equal to that of brilliant sunlight reflected from a horizontal white card. It is obvious that this is too much for direct vision; and any increase in intensity of the light-source makes it the more important that the illumination for one's work should be indirect in character. Before leaving this question, however, it may, in view of the mere physiological aspect, be some guide, by way of contrast, to remark that the comparative brilliancy of the horizontal white card under a dull winter sky is 0·26-candle power per square inch. This is obviously low. Mr. Woodwell states that a brilliancy in excess of 5 or 6 candle power per square inch produces fatigue and irritation of the eyes; and Dr. Bell had suggested 5-candle power as the maximum for direct vision—giving, however, half this value as preferable.

As will be seen, the papers read before the Illuminating Society are suggestive of much that is distinctly useful in matters of illumination; and they are practical in that they also include a number of concrete cases in which the principles enunciated have been borne in mind. The examples themselves, since they are clearly described and accompanied by both photographs and diagrammatic illustrations and curves, afford sufficient matter alone to warrant presentment for discussion.

Proceedings of the Thirty-Fifth Annual Meeting of the Italian Gas Society.—The "Transactions" of this *quasi*-international gas gathering, which was held in Milan last year, and of which an account was given in the "JOURNAL" for Sept. 18 (p. 759), have just been issued in bound form. We note from the list of members that these now number 135, which shows that there is still plenty of scope for enlarging the membership of the Association. The text is given of the petition to the President of the House of Deputies against the proposed enactment for the periodical examination of gas-meters; and among other appendices are the report of Signor Beria on the question of a municipal tax on gas at Turin, and a note by Signor E. Zuccoli on the conditions of employees in works which have become municipalized. The paper presented in the international competition, on "A Comparison of Horizontal, Inclined, and Vertical Retorts," was fully given in the "JOURNAL" at the time (see Vol. XCV., p. 768). The drawings, however, accompanying the paper, which it was thought might be reproduced in the volume of the year's Transactions (as noted p. 768 above), are not even now given, notwithstanding that there are references to them in the text. This is an oversight that we think might have been remedied; and had the drawings been included, the value of the paper and of the published proceedings would have been enhanced.

GAS BILLS FOR 1907.

FIRST ARTICLE.

COMMENCING to-day our customary notice of the Bills that have been deposited for promotion in the ensuing session of Parliament, we deal first with those Companies seeking constitution as statutory concerns.

Portions of the urban district of Annfield Plain, in the county of Durham, have for many years past been supplied with gas from private gas-works situated at Kyo and Dipton, which works are owned by Messrs. W. A. Schultz and C. Comins; and it is now contemplated that these private works shall be transferred to a Company to be incorporated under the title of the Annfield Plain and District Gas Company. Messrs. F. Bridges. C. Comins, W. Hazell, W. C. Parkinson, R. Stapley, W. A. Schultz, H. C. Walker, S. T. Williamson, and others, are desirous of being united into a Company, and to have stututory powers conferred upon them, in order that they may properly provide for and develop the gas supply of the district. Turning to the provisions of the Bill, it is seen that section 13 of the Gas-Works Clauses Act is to be supplemented by the words: "Provided also that every such contract entered into by the Company shall be alike in terms and amounts under like circumstances to all consumers." This, as was recently pointed out in the "JOURNAL," will obviate, in accordance with the last issued model clauses, any necessity for the prescription of specific discounts. The limits of the district of supply are defined. The capital proposed is £45,000, with one-third borrowing. Insurance, reserve, and renewals funds are provided for. Land is scheduled for the purpose of gas-works; and power is required for the purchase, by agreement, of not exceeding an additional 5 acres. The standard price of gas is to be 4s. 3d. per 1000 cubic feet; and the sliding-scale will operate half-yearly, with penny alterations of price carrying 2s. 6d. per cent. changes in dividend. For prepayment supply 10d. per 1000 cubic feet for meter and fittings, 1s. with cooker, and 10 per cent. on cost of meter for meter alone, are the charges proposed in excess of the ordinary price of gas. The illuminating power of the gas is to be 14 candles, tested by the Metropolitan argand burner No. 2, a bar photometer, and Harcourt's 10-candle pentane lamp. It is noted that—

If the illuminating power of gas supplied by the Company shall be below the prescribed number of candles to an extent not exceeding half-a-candle, the Company shall not be liable to any penalty in respect of such deficiency, and if such illuminating power shall be below such prescribed number of candles to an extent exceeding half-a candle, but not exceeding one candle, the penalty to which the Company shall be liable in respect of such deficiency shall be not exceeding five pounds.

The remaining clauses are of the ordinary character. [*Parliamentary Agents: Messrs. Lees and Butterworth.*]

Incorporation and the usual statutory powers are sought by the Boston Spa Gas Company, Limited. The Company have a present capital of £4000; and they have borrowed money amounting to £2300 upon debentures, bearing interest at the rate of 4 per cent. per annum. The Company supply within Boston Spa, and in certain adjoining parishes, including Thorp Arch. As is the general experience, demand is increasing. Hence this application for incorporation and statutory powers. The parishes of Thorp Arch and Walton are within the area of supply of the Tadcaster and Wetherby Gas Company, Limited; but as no supply of gas has been given to these parishes under the Tadcaster Order of 1883, the Boston Spa Company ask for the repeal of the powers. From time to time, the Company have expended various sums of money, out of profits, on the improvement and extension of their gas plant and other appliances; and in view of the present application to Parliament, they have caused a structural valuation to be made of their works, which valuation, together with the working capital, now amounts to £8300, or thereabouts. It is therefore thought reasonable that a sum of £2000 of ordinary stock, representing the aggregate amount of the sums so expended, should be created and distributed rateably among the present shareholders. Provision for this is accordingly made. The Bill prescribes the extended limits of supply, and provides for the vesting in the Company of the property of the limited concern. Capital is sought to the extent of £12,000, whereof, it is suggested, £6000 should be the original capital, and be distributed among the shareholders at the rate of £150 for each £100 of capital at present held, and £6000 should be the additional capital, of which preference shares should not exceed £3000. Inclusive of the £2300 already borrowed, the Company desire to borrow up to one-third of the amount of the issued capital. The standard rate of dividend on the original capital is to be 10 per cent., and on the additional ordinary capital 7 per cent. For preference capital, 6 per cent. is named. Reserve, insurance, and renewals funds are provided for. It is intended that new issues of capital should be first offered to consumers or employees. The gas-works lands are scheduled; and power to purchase by agreement up to 10 acres of additional land is asked. The standard price of gas is placed at 4s. 11d. per 1000 cubic feet; penny variations in price in respect of any year to carry 2s. 6d. per cent. changes in dividend. The standard illuminating power of the gas is put at 14 candles; and testing is to be by the "Metropolitan" argand burner No. 2. Leave is asked to apply for a Provisional Order; and the Directors request authority to fix the remuneration of the Secretary. [*Parliamentary Agents: Messrs. Baker and Co.*]

In the Brockenhurst Bill, we have a proposal for the incorporation of a Company for the supply of gas in the parish named, in the county of Southampton. There are four persons mentioned in the Bill, as well as "other" persons, who have subscribed, and desire to be united in a Company. The limits of supply are only to be the parish of Brockenhurst; but the capital asked for is £15,000, with £5000 borrowing powers. About 2½ acres of land are scheduled for works; and powers to purchase 5 acres by agreement are sought. The maximum price of gas is suggested at 5s. per 1000 cubic feet. It is intended that the standard illuminating power shall not be less than 14 candles; but the burner that it is desired to be prescribed is Sugg's "London" argand No. 1, or other burner approved by the Board of Trade. All other clauses are of the ordinary character. [*Parliamentary Agents: Messrs. Baker and Co.*]

Persons named in the Bude Bill, and "others," are also desirous of being incorporated in a Company, and having powers conferred upon them, for the purpose of providing a proper and sufficient supply of gas to the Urban District of Stratton and Bude. One of the first things noticed in this Bill is that section 13 of the Gas-Works Clauses Act, 1847, is extended by the provision quoted in the Annfield Plain Bill. The limits of supply are defined. The capital contemplated is £15,000, with £5000 as borrowing powers. Land extending to 1⅞ acres is scheduled for gas-works purposes; and it is sought to hold power to purchase by agreement up to 5 acres. The maximum price for 14-candle gas is proposed at 5s.; and Sugg's London argand burner No. 1, or such other burner as is approved by the Board of Trade, is intended to be prescribed. [*Parliamentary Agents: Messrs. Baker and Co.*]

The history of the Grays Thurrock Gas Company, in the making of which various Provisional Orders have assisted, takes up a large amount of space in the preamble of the Bill promoted for the incorporation of, and the conferring of powers upon, the Grays and Tilbury Gas Company. We will content ourselves with saying that up to the present the Company have created and issued 1000 £10 shares, bearing a 10 per cent. maximum dividend, and 5400 £10 shares bearing a maximum dividend of 7 per cent. The Company have received in the way of premiums on the last-mentioned shares £3230, and have borrowed £14,275. In the Bill, it is remarked that section 13 of the Gas-Works Clauses Act, 1847, is also to be amplified in the manner proposed in the Annfield Bill. The limits of supply are described. The capital proposed is £200,000—the original capital to be represented by £10,000 of "A" ordinary capital and £54,000 of "B" ordinary capital; leaving as additional capital £136,000. Including the £14,275 already borrowed, the Company ask for power to borrow up to one-third the amount of capital authorized. The standard dividends are to be at the rates per annum of 10 per cent. on the "A" capital, and 7 per cent. on the "B" capital, and not exceeding 6 per cent. on the preference capital. Reserve, insurance, and contingency funds are provided for. The standard price of gas is proposed at 5s. within a radius of a mile of the gas-works, and 6s. beyond. Operating half-yearly, penny variations of price will carry 2s. 6d. changes in dividend on the 10 per cent. capital, and 1s. 9d. changes on the 7 per cent. capital. There is a discounts clause, but it reads as follows:—

The Company may, if they think fit, allow discounts to consumers of gas in consideration of prompt payment of gas charges not exceeding in any case 10 per cent. Provided that all discounts shall be of equal amount under like circumstances to all consumers, and that notice of any such discounts shall be endorsed on every demand note for gas charges. Provided also that, in the event of a discount given under the provisions of this section being made of an equal amount applicable alike without regard to the circumstances of the consumption to all consumers of gas by means of ordinary meters, the standard price for the purposes of this Act shall be the price charged to such consumers, less the said discount.

The illuminating power proposed is 14 candles, tested by the "Metropolitan" argand No. 2, with a table photometer and Harcourt's 10-candle pentane lamp as the standard. The existing gas-works site is scheduled, with an additional 6½ perches of land adjoining; and land purchase powers by agreement are asked for up to 10 acres. [*Parliamentary Agents: Messrs. Baxter and Co.*]

There is no supply of gas within the urban district of Llandrindod Wells and other places adjacent thereto, in the county of Radnor; and as it is, of course, expedient that a supply of gas should be afforded to the inhabitants of these places, Messrs. W. C. Parkinson, Charles Hunt, F. R. Smith, and C. E. Murray, and other persons who have subscribed, desire to be united into a Company, and incorporated by the name of the Llandrindod Wells Gas Company. Section 13 of the Gas-Works Clauses Act is to be extended in the manner already referred to in preceding notices. The capital proposed is to be £15,000, with one-third borrowing powers. A renewals fund is provided for. About 6 acres of land are scheduled for the works, and power is asked to purchase up to 5 acres additional by agreement. Clauses are inserted for the protection of the London and North-Western Railway Company. The maximum price of gas is put at 4s. 6d. per 1000 cubic feet, with the now usual clause applying to prepayment meters—viz., 10d. excess on the ordinary price for prepayment meter and fittings, 1s. excess when a cooker is included, and 6d. for meter alone. [In the latest model clause 10 per cent.

on cost of meter is mentioned instead of 6d.] The illuminating power of the gas is to be 14 candles, tested by the "Metropolitan" argand burner No. 2, a bar photometer, and Harcourt's 10-candle pentane lamp. It is proposed that there shall be no penalty for the first half-candle deficiency in illuminating power; the clause being in similar terms to that quoted for the Annfield Plain Bill. [*Parliamentary Agents: Messrs. Lees and Butterworth.*]

The next Bill to notice is for the incorporation of the Selsey Water and Gas Company, and to enable the Company to supply water and gas in certain parishes in the County of Sussex. There is no water supply in the parishes of Selsey, Sidlesham, Pagham, and North Mundham, though they are within the area defined by the Chichester Corporation Water Act, 1897. The Petersfield and Selsey Gas Company are affording a supply of gas within the parish of Selsey, as well as within the town of Petersfield. As Selsey is more than 20 miles from Petersfield, and the two places have little in common, it is proposed that the Selsey portion of the undertaking of the Petersfield Company should be transferred to the proposed new Selsey Water and Gas Company, and that they should have and exercise the powers now possessed by the Petersfield Company of supplying gas within the parishes named above. The capital of the Petersfield Company at present consists of £30,000, of which £16,000 is ordinary capital and £14,000 preference; while, in addition, a sum of £7500 has been raised by way of mortgage debentures. The liability to repay these debentures it is intended to apportion between the two Companies—the Selsey Company's liability in this respect being named at £2500. It is proposed that the capital of the Selsey Water and Gas Company shall be £24,000, with £8000 borrowing powers. [The water portion of the Bill will be left for treatment when noticing the Water Bills.] With regard to the gas section, the limits of supply are described; and full provision is made for the purchase by agreement or arbitration of the Selsey portion of the Petersfield gas undertaking. The maximum price of gas is placed at 5s. for 14-candle gas, which it is purposed to test by Sugg's "London" argand No. 1 burner. The Bill provides for the shortening of the title of the Petersfield Company by the omission of the words "and Selsey." [*Parliamentary Agents: Messrs. Baker and Co.*]

The Shanklin Gas Company, Limited, are desiring to be dissolved and reincorporated, with statutory powers. The capital consists of the original share capital amounting to £10,000, and additional capital to like amount, in addition to which the Company have borrowed £5000. Section 13 of the Gas-Works Clauses Act, 1847, is to be amplified in the manner described in connection with other preceding Bills. The limits of supply include Shanklin and Whitwell, and portions of Brading, Sandown, and Newchurch. All the usual provisions appear associated with the vesting of the property in the incorporated Company. The capital, it is proposed, shall consist of £66,000 of consolidated ordinary stock (bearing a standard rate of dividend of 5 per cent. per annum), whereof £34,000 is intended to be divided among the shareholders of the Limited Company—that is to say, £20,000 among the holders of the shares entitled to 10 per cent. dividend, and £14,000 among the holders of shares entitled to 7 per cent. dividend. The additional capital will then amount to £32,000. Including the £5000 already borrowed, the Company desire to borrow up to one-third of the nominal amount of the consolidated ordinary stock, and up to one-third of the additional capital. With a standard rate of dividend of 5 per cent., and a standard price of 4s. 6d. within a radius of 6 furlongs from the main entrance of the gas-works (beyond, it is to be 5s.), the sliding-scale will operate on a basis of penny reductions or increases in price carrying increases or reductions (as the case may be) of 1s. 3d. per cent. in the dividend. For prepayment supply 10d. for meter and fittings, 1s. including cooker, and 6d. for meter alone are the charges proposed in excess of the ordinary. The old clause prescribing 10 per cent. discount for prompt payment and 15 per cent. for large consumption is included in the Bill. The illuminating power of the gas is prescribed at 14 candles—testing being by the Metropolitan argand burner No. 2, a bar or table photometer, and the Harcourt 10-candle pentane lamp. Insurance, renewal, and reserve funds are provided for. Sanction to an application for an Electric Lighting Provisional Order is asked. [*Parliamentary Agents: Messrs. Torr and Co.*]

Mr. Henry Swingler, for some years the Chairman of the Derby Gas Company, and whose death was announced in the "JOURNAL" last September, left estate valued at £361,023.

The German Associations of Engineers, Engineering Firms, and Large Gas-Engine Builders have issued a series of rules and regulations which are to govern in future the efficiency and output tests of gas-engines and gas-producers. They are given in detail in the "Zeitschrift des Vereines Deutscher Ingenieure," and their object is to render uniform the conditions under which tests of these installations are carried out, with a view to get results comparable with others obtained on the same basis throughout the country. The regulations state the points on which the tests are to bear, both as regards producers and engines. The Committee who had charge of the preparation of the regulations included prominent German gas-engine builders and professors, among whom are Mr. E. Körting, jun.; Herr Richter, the Chief Engineer of the Nuremberg Gas-Engine Works; Herr Stein, the Director of the Deutz Works; and Drs. Stodola and Th. Peters, of the Verein Deutscher Ingenieure.

ACCOUNTS OF MUNICIPAL AUTHORITIES.

IT may be remembered that about twelve months ago the President of the Local Government Board (the Right Hon. John Burns) appointed a Departmental Committee, with Mr. Walter Runciman, M.P., as Chairman, on the subject of the accounts of local authorities. The Committee completed the taking of evidence last August; and since then they have held a large number of meetings, at which they have been considering their report on the first and second sections of the reference—viz., the systems on which the accounts are at present kept, and that on which they should be kept. The Committee were to inquire particularly whether or not the accounts should be prepared on a system requiring the entries of receipts and payments to be confined as far as possible to actual receipts and payments of money. Their report on these matters has just been completed, and it will probably be presented after the holidays; while their recommendations on the third section, dealing with the regulations which should be made on the subject—regard being had to the necessity for showing accurately the amounts raised by local taxation and the purposes for which they are applied—will be made known in the spring. Without attempting in any way to forecast the conclusions of the Committee, it may be supposed that they will contain a recommendation for a simplified form of accounts. But whether or not they do so, an attempt in the direction of simplification has been made by Major-General H. P. Babbage, in a pamphlet, entitled "The Bitter Cry of the Ratepayers," of which we have received a copy from the publishers, Messrs. Gee and Co., of Moorgate Street. The remedy suggested for this "bitter cry" is an intelligible system of accounts, with full publicity and a Government audit. Taking the last matter first, the author points out that the auditor deals with the accounts after the money has been spent and the mischief done. It is, of course, far better to provide some check beforehand; and the problem is to find out how this may be effected. The first thing is to have a clear definition by law of the powers and duties of a town council; and the next to stimulate the ratepayers in the selection of capable representatives.

Dealing with the subjects of municipal administration and finance, the author says the dominant idea should be to make out the accounts in a uniform shape, applicable to every borough, and as intelligible as possible to the ordinary ratepayer. With this view, he thinks the national Budget system should be adopted as far as practicable. He advises the preparation of a monthly statement, containing in one column the names of the payees of cheques and the amounts due to each, and in the other the items dissected according to the Committees responsible for them. The totals of the two columns should, of course, agree. Examples of these statements are given, and the author explains that they must be dissected and rearranged under the budget heads. The result will, he considers, be a set of accounts which are nothing more than a classified list of receipts and payments which any ordinary ratepayer will be able to understand. But in order to bring them together, and to give a double entry, there should be an abstract from the bank pass-book for the year and a summary of all the separate accounts. Major Babbage next shows how the income and expenditure accounts can be worked out from the receipts and payments by incorporating with them the outstanding balances at the end of each year. Passing on to deal with the estimate for the rate, he points out that no rate can be made, under either the Municipal Corporations Act, 1882, or the Public Health Act, 1875, which includes items both prospective and retrospective; the object being to make the rates for the year cover the expenses, and to secure careful management. Yet he says that in some boroughs "this salutary provision is habitually disregarded, and ratepayers are deceived as to the true poundage of the rate." In the case of the authorized trading undertakings of a local authority, such as gas, electric lighting, or water supply, the budget should take the place of the estimate for the rate. Under the management suggested by the author, he thinks no "wild cat" scheme could be suddenly brought forward and adopted without due consideration and regard to expense.

On the subject of capital, which for the trading undertakings of a corporation can only be obtained by loan, the author emphasizes the necessity of keeping it distinct from the revenue, as shown in the summary of receipts, payments, and cash balances, in which it will take its proper place. The accounts of the sinking funds should also be kept entirely separate from all others. Forms of the sinking fund accounts as proposed are given; and these are followed by some remarks on auditing and the duties of elective auditors. The audit by the latter, the author says, resolves itself for the most part into a verification of the arithmetical accuracy of the figures, which is unnecessary, "because the accounts may be so arranged as to show double entries and prove themselves to the eyes, and so satisfy the ratepayers of their correctness; and next because an error very rarely occurs." The real work of the auditor comes after the arithmetical test is completed. It sometimes happens that one of the elective auditors will not sign the report of his colleague. An instance of this is given; and Major Babbage says such audit can be of little use, especially if the accounts are reliable, and arranged on a proper system of double-entry and coherence and continuity. The author concludes by advising property-owners and ratepayers' associations to be wide awake and aggressive,

and to do the best they can under the law as it stands if they cannot get it altered. Boroughs should, he says, select as their elective auditor a qualified and resolute man who will report to the Council and to them all irregularities. But he points out that the ratepayers should not "think in pence," but pay their auditor sufficient to attract a competent man.

THE IRON AND STEEL TRADES IN 1906.

The past year has been one of rising prices for metals generally—and for copper and tin especially—and this, it must be remembered, in its turn followed a twelvemonth of substantially improving conditions. As regards the iron and steel trades, business everywhere has been on a very large scale indeed. But while the past, of course, is interesting from an historical point of view, it is with the future that both buyers and sellers are chiefly concerned; and thus the question of what is likely to happen this year, is very much more important than the consideration of what occurred last. It is therefore enlightenment on this point that we seek first of all on opening the annual report of Messrs. Bolling and Lowe—who have in the past proved themselves capable of forecasting "coming events" with a praiseworthy degree of accuracy. On the present occasion, then, we find that the firm, referring to pig iron, give it as their opinion that there is no reason to anticipate, in the next few months at least, a reversal of the present favourable conditions. For six months, it is felt that the situation is assured; but that further than this it is risky to hazard conjectures.

As to the steel rail market, the report states that prices have been maintained at the rates fixed by the International Syndicate; and though the demand has not been all that manufacturers could desire, they have doubtless benefited more by the higher prices attained, as the result of the Syndicate, than they would have done by a larger output at competitive rates. This country is about to lose an old customer in the shape of the Swedish State Railways, as plant has been laid down in that country for the rolling of rails; while another feature of importance is the process of rolling down old rails into sleepers, which, if it is generally adopted, will kill the wood sleeper trade. The decrease in rail exports from England up to the end of October, as compared with the previous year, amounted to about 70,000 tons. Joists and structural material substantially advanced in price during 1906; the San Francisco earthquake being largely responsible for this—as it was also for a fillip to the cement trade. In the event, however, the anticipation that large quantities of beams, &c., for the re-building of the city would be purchased in Europe, was not realized, though several purchases were made. It is now thought probable that the United States will themselves supply the requirements.

In the pig iron trade, the feature of the year was the demand by America for supplies from this country. Predictions had, say Messrs. Bolling and Lowe, been indulged in for many months that the United States would be compelled to supplement home supplies by drafts made upon foreign producing centres; but the hope had so often been doomed to disappointment that a feeling of lassitude was everywhere maintained, till it became apparent that the United States blast-furnace men were no longer able to satisfy the hunger of home consumers. Many thousands of tons of Scotch iron—which is the class chiefly favoured by Americans—have already been purchased; and the speculative buying which ensued in this country on these transactions becoming known, considerably raised prices. In Germany, also, manufacturers found themselves unable to cope with the demands, and extensive shipments were made from this side. In fact, it is remarked that the year has been one of unprecedented prosperity for Germany in the iron and steel and kindred trades; and in almost all branches orders have been booked so far ahead that nothing in the way of new work can be taken in hand before well into 1907.

These branches of industry are also in a very flourishing condition in both France and Belgium. General trade in the United States is, as we know, prosperous; Mexico is continuously growing commercially; while the state of affairs in Canada and the Commonwealth of Australia is gratifying in the highest degree. Messrs. Bolling and Lowe, indeed, sum up the situation by remarking that the general result of 1906 may be taken all round as very satisfactory; and those countries whose staple industries are the production of iron and steel, and the cultivation of allied trades, have had a time of exceptional prosperity. Most other countries, and those Colonies whose well-being depends upon agricultural productions, have also very little to complain of, so that the year 1906 may be looked upon as one of special prosperity to almost every civilized nation.

It is stated that the past year's production of pig iron in this country has approximated 10 million tons. This compares with about 9½ million tons in the preceding twelve months. The value of the exports of iron and steel for the eleven months ending on Nov. 30 in each of the past three years has been as follows: 1904, £25,911,557; 1905, £29,561,408; 1906, £36,917,985. At the middle of December, 1904, the price of hematite pig iron warrants was 56s. 2d. per ton; in 1905, 71s. 6d.; and in 1906, 80s. At the same dates, the figures for heavy steel rails were £4 10s., £6, and £6 10s.

ITALIAN TEXT-BOOKS ON GAS-ENGINES.

Some little while ago—on April 24 last year, to be exact—we commented, in "Editorial Notes," upon the comparative backwardness of Italian gas technicians to record their experiences in writing; and we regretted that Italian gas engineers had not played that prominent part in general technical literature that they might have done, and as their electrical *confrères* had. We hazarded the opinion that it was "merely a question of time before we see gas technics in Italy taking their proper place in current technical literature." Significantly enough, in the very same month, Signor Vittorio Calzavara, the able Editor of our Italian contemporary, "Il Gaz," was writing in a similar strain. We learn this from his preface to one of two Italian books* we have received dealing with gas-engines and poor gas. Signor Calzavara had previously endeavoured to remove the stigma referred to, not only by establishing in Italy his interesting monthly gas periodical, but by his text-book on the gas industry—"*Industria del Gaz Illuminante*." He now follows this work up by one of some 400 pages and 160 illustrations, dealing with the subject of gas-engines. He commences his preface thus: "In my sufficiently long gas career, I have had opportunity of observing that in Italy there is a great deficiency in the study of gas matters. Yet this industry is a most important one, and by and from it so many other industries are driven and derived. In other countries, which are in the same front rank of progress, there are schools for gas men; and books on gas are not wanting. Here in Italy, there are no gas schools; and Italian books on gas are very scarce." This scarcity is now gradually being remedied.

The author gives a fairly ample and international bibliography of gas treatises, and he then proceeds to trace, in an interesting and exhaustive way, the origin and development of gas-engines. After classifying them, a chapter is devoted to the different kinds of gases that are used in internal combustion engines—from coal, water, and poor gas to blast-furnace gases, acetylene, petrol, and alcohol. The various mechanisms are afterwards described and illustrated; and the concluding chapter gives general instructions for the management and maintenance of gas engines. Altogether the book is a very useful and practical survey of an increasingly important subject.

The other Italian text-book that we have received—that by Ingegnere Fosco Laurenti—is, in some respects, the complement of the previous one. It looks at the subject of poor gas and gas-engines more, perhaps, from the point of view of the mechanical engineer. It fills in, in detail, the supplementary mechanisms and technical and constructional considerations that might not find a place in the former book. The author first considers fuel; then producers; and subsequently he devotes the bulk of his space to detailed descriptions of, and calculations relating to, the various organs and accessory appliances. Many tables and experimental results are given; and the book is certain to prove of great service to gas-engine students and designers, though an index might have added to its utility.

Both these treatises are issued by the well-known Milan publishing firm of Ulrico Hoepli, whose text-books fill a very similar place to that of the English Weale's series of scientific and technical works. The publishers are to be complimented on the educational function they are fulfilling in Italy; and the low price at which their neatly bound and well-printed publications can be bought, brings them within reach of all technical students.

* "*Motori a Gaz.*" By Signor Vittorio Calzavara. Ulrico Hoepli, Milan. "*I Motori ad Esplosione a Gas Luce e Gas Povero.*" By Ing. Fosco Laurenti. *Idem.*

A REVIEW OF MUNICIPAL TRADING.

Some four months ago, we briefly noticed a book by Mr. Hugo R. Meyer, of Chicago, which dealt with the effect of municipal trading on private enterprise; and now we have before us a recently published work by Lord Avebury (which has attracted a considerable amount of attention) treating mainly of the financial aspect of municipal enterprise.* The author is, of course, a well-known speaker and writer on the subject of his present book; and if any doubt existed—which it does not—with regard to the great weight that should attach to his utterances, the outcry of those who hold opposite opinions to himself would be quite sufficient to dispel it. There is, of course, much in his present work with which those who have been in the habit of listening to his annual addresses to the Industrial Freedom League have become familiar. But the arguments are of a kind that cannot be too often repeated; and, besides, the setting forth of the whole case against municipal trading—or rather heavy municipal indebtedness—in a compact volume like the one under review cannot fail to be of assistance to all who wish to make a comprehensive study of the question, to whichever side their sympathies or their convictions may tend to lead them.

Everybody will not agree with Lord Avebury's conclusions—it is not to be expected that they should do so; and perhaps some

* "On Municipal and National Trading," by the Right Hon. Lord Avebury, P.C. Macmillan and Co., Limited. London; 1906. 5s. Net.

may even challenge his facts. But however this may be, a brief indication of the contents of the book will no doubt induce those who are interested in the subject to read it for themselves; and so we will content ourselves with this. Those who hold opinions on anything like the same lines as Lord Avebury's will be grateful to him for his vigorous championship; and even those who do not find themselves in accord with all that he says, will nevertheless feel that he has done good work in so prominently discussing the matter. As has already been mentioned, financial considerations occupy a large proportion of the eleven chapters of which the volume is composed; and the rapid increase in local expenditure of recent years is his text. But the monetary aspect, although of very great importance, is not, he shows, by any means all that has to be taken into account. In fact, he sets forth five grounds on which he holds that the running by municipalities of commercial undertakings is mainly undesirable. These (which it may be remembered he quoted at the annual meeting of the Industrial Freedom League last July) are as follows: Firstly, the legitimate functions and duties of the municipalities are already quite enough, if not more than enough, to tax all their energies and fill up all their time. Secondly, it has involved, and will involve, an immense increase in municipal debt. Thirdly, it will involve municipalities in labour disputes. Fourthly, as there will not be the same stimulus to economy and attention, there will be a great probability, not to say certainty, that one of two things will happen—either there will be a loss or the service will cost more. The working classes will, of course, be the greatest sufferers. Fifthly, it is a serious check to progress and discovery. It should, however, be borne in mind that in all that is said in support of these contentions, it is not persons who are attacked, but the system. It is argued that governments and municipalities cannot work as economically as private enterprises, and that therefore municipal trading must increase the rates more and more. The author says: "It has been a surprise to many that, while our commerce is undoubtedly flourishing, the distress this year [1906] should have been above the average. Is not one reason the crushing weight of rates and of taxes? We are paying £68,000,000 a year more in taxes (and about the same amount more in rates) than we were ten years ago; so that between the two we are paying £130,000,000 a year more."

Under the heading of "The Duties of Local Authorities," the varied work of the London County Council is set forth; the items on the *agenda* for one particular meeting (which, however, was about twice the usual length) being enumerated. On this occasion there were 38 reports of Committees and over 500 resolutions to be passed by the Council in one afternoon. This is altogether apart from the duties undertaken by many of the members of the County Council on the Metropolitan Water Board and the Thames Conservancy. On the subject of the increase of municipal debt, it is unnecessary to say anything here. Readers of the "JOURNAL" are fully acquainted with the figures. In the chapter on "Labour Questions," a matter is drawn attention to which has been commented upon in many quarters—the enormous influence which municipal employees can exert at local elections for purely personal objects. The truth of this will be manifest, when it is mentioned that already in some cases the municipal employees account for 5 per cent. or more of the total number of voters. After dealing with the housing of the working classes, the reader is brought to a consideration of the question of "Loss and Profit," in which tramways, gas-works, and water supply are specially dealt with, as being the cases "which are generally put forward as affording the strongest illustrations in support of the supposed advantages of municipal management." This matter of profit and loss is, of course, one of the most contentious of all the aspects of municipal trading; and it is impossible to go over all the ground here. Suffice it to say that Lord Avebury quotes the Provincial Company and Corporation prices from "Field's Analysis," and concludes that "in places supplied by companies, gas is substantially cheaper than where it is in the hands of the municipality." But it is true that circumstances vary in different cases; and Lord Avebury admits that, in comparing gas undertakings, there are several things besides the price of gas to be considered. These, however, he does not in any way regard as weakening his case for company management. He thinks that the sliding-scale system seems better for the ratepayers than municipal management; while another important point is that where the gas is supplied by companies the municipalities watch jealously over the quality, "but where it is supplied by the municipality we have no such guarantee." So far as water supply is concerned, the author grants that sometimes municipal management is desirable; and that this is perhaps the strongest case for municipal enterprise.

The remaining chapters of the book deal with the "Effect of Municipal Trading on Private Enterprise," "Railways," "Interests of Working Men," and "Representation without Taxation, and Taxation without Representation." We must, however, leave these, and content ourselves with quoting the conclusions (beyond the five main objections to municipal trading contained in the opening chapter) set forth at the end of the book. They are as follows: That profits are only made (if at all) when municipalities have a monopoly. They are confined to business such as the manufacture of gas, which has long been established and reduced to regular rules. That even in such cases the accounts have been so kept as to make it impossible to determine what the real result has been. That the profit (if any) has been but small; and that much more satisfactory and remunerative results might have been obtained if the works had been leased to private companies or firms. That it is unwise to give votes to those who pay no rates, and unjust to withhold them from those who do. That by reducing the demand for labour, while increasing prices and raising rates, municipal trading has not only injured the ratepayers generally, but especially the working classes; and if carried to its logical conclusion, it will involve the loss of their freedom. The recommendations of the author are a uniform system of accounts for local authorities; votes for companies in some reasonable proportion to the rates they pay; and, most important of all, that "when the debt of a local authority exceeds the rateable value by a certain proportion, their stocks should be removed from the list of trustee securities."

Lord Avebury, in support of his arguments, quotes largely from the speeches and writings of various people; and the book is certainly none the less interesting on this account.

RELATIVE VALUE OF STANDARDS OF LIGHT.

AT the request of the International Commission on Photometry, investigations have been made in the experiment laboratory of the Conservatoire des Arts et Métiers, by MM. Perot and Langlet, and in the Laboratoire Central d'Électricité, by MM. Laporte and Jouaust, with the view of obtaining an exact idea as to the relations existing between the values of the standards of light used in different countries; and the results of their investigations have lately been published in the "Comptes Rendus." The measurements were made either directly by the simultaneous comparison of three sources of light—the Harcourt, the Carcel, and the Hefner—one with the other, or indirectly by comparing them with an intermediary electric light. In order to obtain harmony between the operations carried on with very different degrees of humidity (varying from 10 to 18 litres of aqueous vapour per cubic metre of dry air), it was recognized that the intensity of the Carcel lamp was affected by the moisture in the atmosphere in the same manner as the two other light sources; and the necessary correction was made for it. This having been done, the results of the measurements made are as follows:—

	Harcourt-Carcel.	Hefner-Carcel.	Hefner-Harcourt.
Direct measurements. .	1·009 ..	0·0932 ..	0·0933
Indirect ,, . .	1·000 ..	0·0929 ..	0·0929

It may be remarked that the product of the three relations, identical with unity in the indirect measurements, might have systematically differed from unity in the direct measurements, if the tints of the lights had influenced them. This effect, if it exists, is entirely masked by the accidental errors. In this respect, the direct comparisons had a certain interest, as their agreement with the indirect measurements demonstrates that, for the light sources studied, each of them may be specified by a number which can be introduced into the numerical calculations, though it is the result of a physiological impression. In short, taking the average of the results given by the two methods, we have the following table:—

	Value of Lamps.		
	Carcel.	Harcourt.	Hefner.
Carcel	1 ..	1·004 ..	0·0930
Harcourt	0·996 ..	1 ..	0·0931
Hefner	10·750 ..	10·740 ..	1

These investigations, the authors say, have once more brought into evidence the difficulties attending the employment of the existing light standards (the accidental variations of which may be great), which necessitate corrections, and have proved the value which a standard based upon a physical phenomenon as independent as possible of exterior conditions—*e.g.*, the Violle—would present.

Inter-State Water Rights in America.—Inter-state water rights are involved in an important decision recently given by the New Jersey Court of Errors and Appeals. In 1905 the Legislature enacted a law prohibiting the diversion to other States of any of the potable waters of New Jersey. The Hudson County Water Company made a contract with the City of New York to furnish the borough of Richmond with a supply of water from sources controlled by the East Jersey Water Company. The Attorney-General of New Jersey brought an action to restrain the Hudson Company from carrying out this contract, on the ground that it was a violation of the Act mentioned. The Company contended that the Act was unconstitutional; and it is this contention that the Court of Final Jurisdiction has just overruled. The Court pointed out that common law recognizes no right in the riparian owner, as such, to divert water from streams in order to make merchandise of it; and the State has not, by statute, changed this rule. On the contrary, the legislative policy has been to preserve and administer the waters of the State for the benefit of its rapidly-growing population. There is no provision of the Federal Constitution violated by the law of 1905; and consequently the Hudson Company have no right to contract to deliver any potable water from the State of New Jersey to New York City.

SIR ALEXANDER KENNEDY ON SPECIFICATIONS, CONTRACTORS, AND CORRUPT COMMISSIONS.

THE Presidential Address which Sir Alexander B. W. Kennedy delivered to the Institution of Civil Engineers on Nov. 6 last, has just been circulated in pamphlet form among the members. A brief outline of this interesting, and rather unique, presidential utterance was given in the "JOURNAL" for Nov. 13 (p. 447), and was again referred to in our editorial columns on the 27th of the same month. We particularly referred to Sir Alexander's comments on the drafting of specifications, and the relationship between engineers and contractors. As these topics—though frequently dwelt upon—are of present and permanent interest, readers may care to have brought to their notice, in fuller form, the remarks upon them of the President of the Institution of Civil Engineers. Upon the subject of specifications, he says:

All engineering work of importance is carried out according to both a specification and a contract. An engineer prepares the specification and is practically responsible for the contract; while very often other engineers—from the manufacturing side—accept both documents, and undertake to work to them. There is little doubt that the more strictly legal—which means in this case equitable—the conduct of both parties is in reference to these documents, the less the probability that the aid of the purely professional lawyer will have to be called in later on.

On the manufacturer's side there is one chief and simple, but absolutely necessary, duty to perform in reference to these documents—namely, to read them. The duty is as simple and as obvious as "keeping your eye on the ball" in another phase of activity, and is just as often neglected. Hence many tears! If the contractor or manufacturer is dealing with a responsible and experienced engineer, he may be sure that the documents are intended to mean what they say, and that (barring mistakes) they do mean it. If, therefore, he finds that he cannot do what he is asked to do, there is nothing to be gained by slurring it over. The only means of avoiding trouble is the raising of all doubtful points before the work begins, so as to get them settled. If, on the other hand, the contractor is dealing with an irresponsible or inexperienced engineer, and no doubt there are such, it is all the more necessary that he should know exactly what he is asked to do. For in that case there may be meanings in the documents which only careful reading will discover, but which will certainly be taken advantage of, later on, against the contractor himself.

On the side of the engineer who draws up the specification, it is surely his duty, after drawing it up—after stating as clearly as possible his requirements—to endeavour to go through it from the point of view of the contractor, and make sure that there can be no reasonable doubt of the meaning of the words or phrases he has employed. This is every bit as true of the specification as of the contract. But whereas with the latter there is always legal help available, with the former the engineer has to trust to his own power of exact expression in saying just what he wants, and no more and no less than he intends to have.

The question of how much, or how little, to put in a specification is one about which no very general rule can be laid down. Naturally much depends on the engineer, on the contractor or manufacturer, and on the nature of the work. But, first and particularly, it is the duty of the engineer to define exactly what results he wishes to obtain. If he is unable to say what he wants, he can hardly be the right man for the work, and had better leave it alone. He can also say, quite exactly, the nature of the materials he requires to be used. In the majority of cases, he can also say in what way the work is to be carried out; what machinery or apparatus or appliances are to be used; and how they are to be arranged or applied. Or, if there are several ways in which his requirements can be met, he can indicate one of them, and leave the contractor to suggest others. No doubt, cases arise in which the requirements are such as can be fully met only by certain methods or appliances of a particular manufacturer or contractor; but as a rule a specification cannot be too full—it can certainly never be too clear—in dealing with general requirements and results. In details, however, it may very easily be too full; and no greater mistake can be made—nor any mistake more likely to lead to vexatious litigation later on—than to crowd a specification with detailed particulars as to matters which every competent contractor or manufacturer can carry out equally well in his own way. I would therefore put, as the characteristics of a good specification, definiteness and clearness always, fulness as to requirements and as to guarantees, freedom and openness as to those details and methods which are largely matters where contractors have had very varying experience.

We cordially endorse these views, which, indeed, have frequently been recorded, in varying phrases and at various times, in our columns. Especially would we commend the observation that it is the duty of the engineer, having drawn up his specification, "to endeavour to go through it from the point of view of the contractor." This may be a difficult task to some engineers, who have never had actual experience as contractors' assistants; but it is one that should be diligently gone through all the same.

Continuing, the President considered the position of affairs where the engineer is made the sole judge and interpreter of his own specification. This is a point that was also touched upon by Mr. C. E. Brackenbury in the paper he read, upon "Some Legal Notes on Contracts and Specifications," before the Society of British Gas Industries.* While there is general agreement in the views expressed, Sir Alexander Kennedy seems to think that, if an engineer "has said exactly what he wanted, in terms which could not reasonably be misunderstood . . . he can make his decision as fairly as if he were an arbitrator." This we hardly believe likely to prove to be the case, the fallibility of human nature being what it is. Even in such a case, the engineer would have to decide that his own language was not able "reasonably" to be misunderstood; and if the engineer's reasonableness of interpretation were the matter in dispute, it would surely be better to let the contractor have the benefit of an independent person's decision or opinion. We will give the presidential extract in full:

Personally, I have very strong views as to the inadvisability of making an engineer the arbitrator in relation to his own specification, although I know that some public bodies have different ideas. But even where the engineer is not the final arbitrator, there are sure to be many points of detail, in relation to the carrying out of the work according to the specification, which he solely will have to settle. And in these it is very desirable that his attitude should be as far as possible that of an arbitrator rather than of a party to a dispute. It is really here that the special importance of definiteness and clearness in the original wording of his specification comes in. If he has said exactly what he wanted, in terms which could not reasonably be misunderstood (if they had been reasonably and carefully read to start with), he can make his decision as fairly as if he were an arbitrator. But if his specification has not been clear, or has been insufficient to start with, his decision must necessarily be coloured by his own unexpressed intentions—his own view of what he meant; so that, although honestly given, it may not be by any means certainly the decision which an arbitrator would have given under the same conditions. Strictness, or even what is called severity, in a specification is not in itself against the interest of the contractor. As long as he can see what is wanted, it is his business to prepare for it. If the contractor presumes on the engineer being slack in construing his requirements, that is his fault; and he is rightly penalized when it turns out that he has caught a tartar. But a carelessly worded specification, or one in which important requirements are slurred over or only indicated inferentially, is unfair to the contractor, is unworthy of the engineer, and is likely to lead both into trouble as well as to result in unsatisfactory work.

The last topic to which we wish to draw attention is one that is much to the front at the present time—the subject of secret commissions. Though some may find Sir Alexander's phraseology upon this delicate matter not quite direct enough for their liking, his own opinions are not for one moment left in doubt; and with the warm support of the head of the engineering profession, coupled with the new legislation "for the better prevention of corruption," it is to be hoped that much will be done to uproot the cancerous growth that has sprung up in the commercial and professional life of the country. The President's observations are the following:—

With ordinary commercial life, every engineer stands in very close touch—the manufacturer, of course, directly, the consultant indirectly but hardly less intimately. We shall not go wrong, any of us, if we can only make up our minds that, as to our work, whether hand work or brain work, metal work or paper work—its quality is the first thing to be considered, and that, as to ourselves, no amount of profit is worth having if it is obtained by us as mere money-getting machines and not as gentlemen. We are rather fond of talking loosely of engineering as a "profession." I am not sure what authority is entitled to say whether engineering is or is not a profession. It must be a very young one certainly, if it is one at all. But by all means let us call it a profession, and then let us do our work accordingly. I fear it must be confessed that with some engineers things have occasionally not been thought unworthy or improper which, although not in themselves dishonest, would be impossible among lawyers or doctors, which ought to be impossible among gentlemen, and which would be impossible among ourselves if our organization were as complete, and our etiquette as strict, as in the older professions. I ask members of this Institution to keep before them—for their own sakes as well as for the honour of the Institution—an ideal of business or professional conduct at least as high as exists in the older and recognized professions of Law or Medicine, even although honourable behaviour cannot, among us, be enforced by legal penalties or disqualifications. Even the warmest admirer of free imports in the physical world will admit that in the world of ideas—which after all is the real world—there are some importations which we would willingly prohibit altogether. And for us engineers such an import (I hope it is not, after all, a native manufacture) is represented by the notion that an engineer may remain a gentleman in his private capacity, while in business affairs he habitually sets "smartness" before honesty, and money-getting before everything.

A concluding paragraph deals with an allied subject, and one with which the gas industry is, unfortunately, not altogether unfamiliar. It is the situation that arises where a man tries to be both a consulting engineer and a contractor at one and the same time. He endeavours to hunt with the hounds and run with the hare. Sir Alexander says: "Every such attempt, so far as I know, has ended in failure, and I am sure that the combination is to be deprecated." He would go so far as to say "that a consultant ought not even to hold shares in any manufacturing company with which there is the slightest chance that he may have to do in his professional capacity." This may sound a "counsel of perfection;" but we are quite convinced that such a high tone of commercial and professional morality as is so worthily and rightly held up by Sir Alexander Kennedy must be of the greatest benefit to the industry or community striving after it.

* See "JOURNAL," Vol. XCIII., p. 644.

Lignite in gas-producers is reported by Herr H. Neumann, in the "Zeitschrift" of the Society of German Engineers, to be giving satisfactory results when the gas is cleaned. For example, at the 250 H.P. plant of the Kalk Chemical Works, a 321-hour test of a 70 H.P. generator was made, corresponding to a run of 1½ months, and only a very thin layer of soot on the exhaust-valve resulted, not causing any trouble in working. Brown coal briquettes were used.

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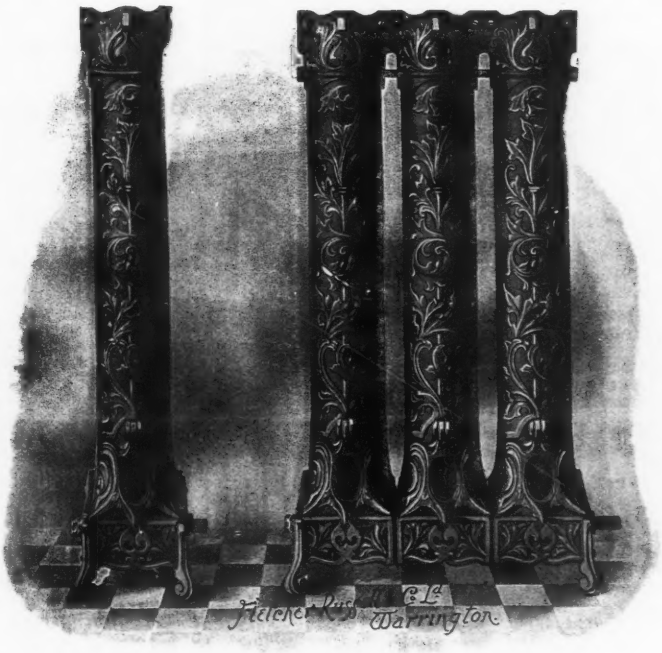

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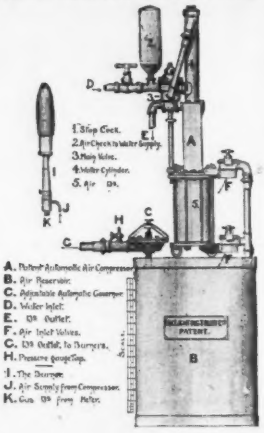

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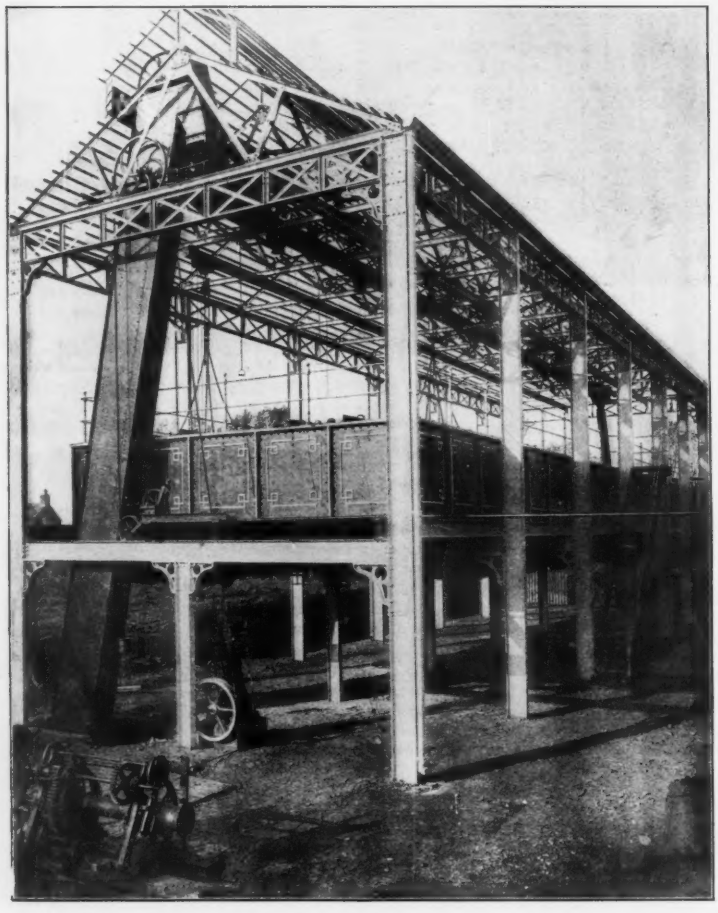

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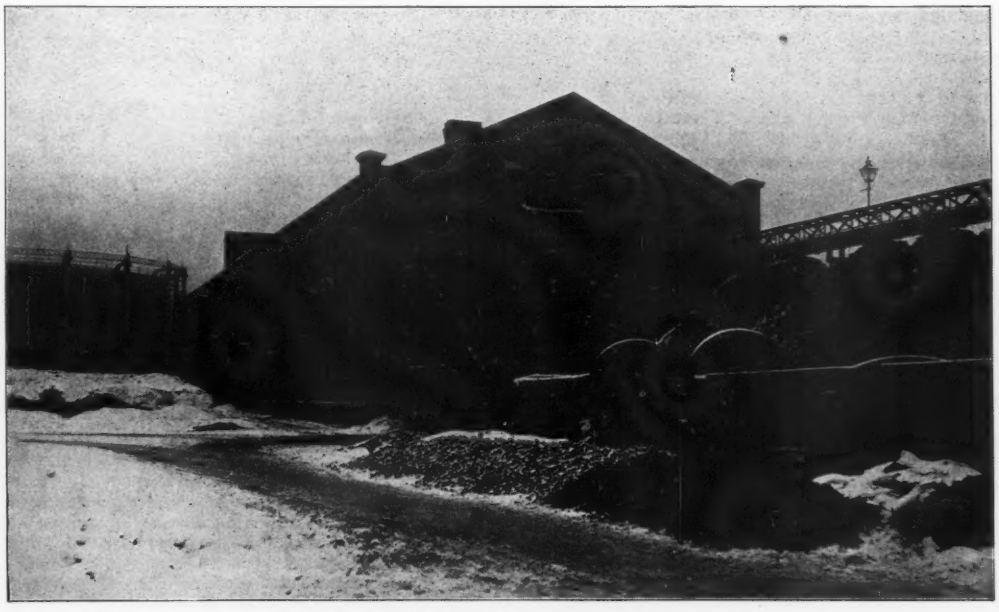
THE TRANSFORMATION OF A RETORT-HOUSE AT LOWER SYDENHAM.

Those among us who knew the works of the South Suburban Gas Company (then the Crystal Palace District Gas Company) years ago, and whose acquaintance with them has only been renewed at long intervals, have some difficulty in recognizing in the modern works now to be seen there much likeness to the old. Old structures and old methods have given place to new. The change, however, has been a gradual one; the exigencies of circumstances demanded from the Board and their Engineer that, in the scheme of reorganization and modernizing, the utmost should be made of what existed, and that the alterations should be carried out with the least possible increase of the capital account. This has been done, and the Company are to be congratulated upon having a works thoroughly up-to-date, with the producing part equal to a considerable future accession of business. This has been accomplished at the lowest possible cost, consistent with good work, and with the minimum trespass upon capital. From time to time, it has been our privilege to describe portions of the work as it has proceeded; and now we are, through the facility afforded by Mr. Shoubridge, in a position to illustrate and give details of one of the retort-houses which is a central feature of the works to-day.

The Raison d'Etre of the House.

As one stands looking at one side of this house, with its fine length of 324 feet, there comes to mind the old place and its equipment which it supersedes, which in its early years was regarded as the most correct of structures for the purpose of carbonizing coal for the production of gas. But judged by the more exacting modern standard, that house was unfitted for proper working, and was uneconomical. Its walls and its roof are incorporated in the present building; and they are all the evidence that remains of its former working existence. There have been other retort-houses in the country that have had their roofs raised and walls heightened to make them suitable for present-day conditions; but we know of no other in the country that has been extended and altered as this has. For not only have the walls and roof been raised, but the house has been extended some 124 feet at one end. The house is equipped with one long bench of retorts, allowing the stoking machinery to be employed under conditions of maximum efficiency and economy.

The old house was 200 feet long by 70 feet wide by 23 feet high; and it contained twelve beds of sevens, and six beds of sixes. The retorts were worked by hand, and were heated by furnaces of the old open type. The settings, at the time the scheme about to be described was taken in hand, were practically exhausted; and, as has been intimated, they were too expensive to work, according to current notions and experience. From the bringing in of the coal to the depositing of the coke on the coke-heap, it used to cost with the old house 2s. 4d. per ton of coal carbonized; now in the new house, it costs 10·6d. per ton. There is here the justification for what has been done. The difference is emphasized when it is considered that in the new house 360 tons of coal are carbonized per twenty-four hours. The saving between 2s. 4d.



A Quiet Scene with Good Demand for Gas during Christmas Week.

and (say) 10½d. is 1s. 5½d. per ton; so that we have here a difference to the good between the carbonizing wages under the old and the new conditions of over £26 per day. Such a saving soon pays interest on the machinery; and there is besides the relief to the men from the exhausting and laborious work of scoop driving and hand drawing.

The Conversion of the Old House, and the Features of the Present One.

The house as it now stands is 324 feet long, 70 feet wide, and 40 feet high to the wall-plates; so that the old portion of the house had to be raised no less than 17 feet. The stage-floors are 10 ft. 10 in. from the ground-line. Of course, in order to accommodate regenerator furnaces, it was necessary to go either up or down. Underground floors, in the case of a retort-house, are objectionable in many ways. They are dark, difficult to ventilate, unpleasant for the men to work in, and costly to build, as the ground has to be excavated. For these reasons Mr. Shoubridge decided to build upwards to the height required, and to raise the roof of the old portion.

The raising of the roof was an interesting feature of the work. It was done in three sections of nine principals at a time, in the following manner: The walls were first built up to the required height along the entire length—chases being left in them to allow the principals to go up. When the walls were built, baulks of timber were placed along the top, so as to stand over the chases, and carry the bolts by which the roof was raised—nine principals, as previously stated, being raised simultaneously. The bolts were jointed together in 5-feet lengths—the top length being screwed, and fitted with a suitable nut. At the time of raising, a man was placed at each of the bolts with a spanner—eighteen men being so engaged. At a given signal, each man made, according to prearrangement, six to eight turns at a spell. Then there was a brief rest, and afterwards the operations were repeated until the men had lifted the section of the roof 5 feet. The brickwork was then built up underneath each principal; and when it was set, a length of bolt was taken out. The bolts were then coupled up again, and the operations were repeated until the full height of 17 feet was attained. The photographic illustrations will make the character of the work clear, with this description of the operations involved.

While referring to this work of raising the roof of the old portion of the house, it may be mentioned that the 124 feet of new roof required for the extension of the house was made by the Gas Company's own works' fitters, who also elevated the roof and finished it complete, including the slating. There is no need for a detailed description of the new portion of the roof; as we give a drawing of half a principal showing the dimensions of the members. It will be remarked that it is quite a simple structure, with an open ventilator along the top, after the manner of the first retort-house put up by Mr. Edward Drory at the Mariendorf (Berlin) works. The free vent for steam, dust, and smoke allowed by an open arrangement of this kind has a remarkable effect, aided by good ventilation from below, in maintaining clear conditions inside a retort-house.

This brings us to the brickwork. The design of the building is shown by the photographs. Here again, we have an example of the self-contained character of the South Suburban Gas Company's works. The bricks required for raising the old portion of the house, and for building the new part, the coal-breaker pits, &c.—bricks numbering over a million—as well as the stone for the sills and plinths, were all made by the Company's own men.

We have spoken of the excellent ventilation of the house; and anyone going into it must be struck by its lightness and airiness. Several things contribute to this desirable result. There is the great length of the house the open ventilation at the top, and the numerous openings for access and egress at the ground-level and for light at the upper part. But there is another thing that tends to create a direct upward current throughout the house, and which could not be so well obtained under the usual circumstances. It is that the stage-floors do not extend the full width between the retort-bench and the house walls, so that there is a considerable opening left the whole length of the house on both sides. This contributes wonderfully to a clean, fresh atmosphere, and to the comfort of the men. Modern conditions of working enable this to be accomplished. There is now no drawing to be done, or other work than the opening and closing of lids, and the cleaning of the ascension-pipes. Under these circumstances, there is no necessity for wide stages. The stage-floors themselves are simple structures, being made up of steel girders, covered by ribbed cast-iron plates; the girders being carried at one end on the buckstays of the bench, and at the other end by cast-iron columns. Hand rails finish off the stages at the open side.

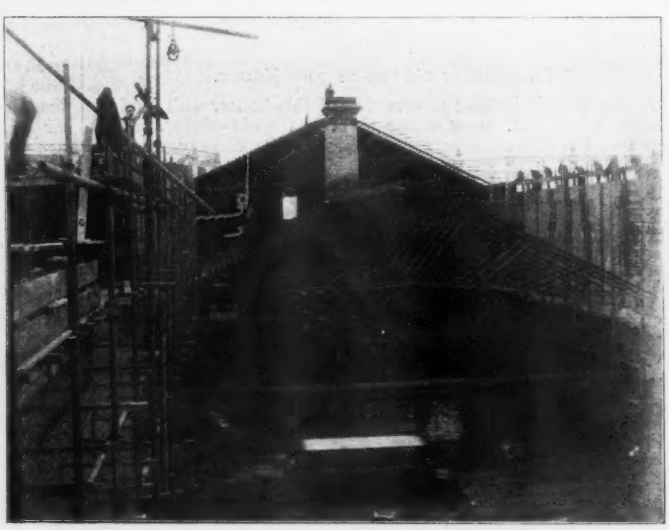
A Wide and Simple Retort-Bench.

If there is one thing more than another that strikes one about the engineering work at Lower Sydenham, it is the absence of elaboration, but pronounced practical reasoning for what is done. We are not referring to building design, but to equipment. Illustration is found in this bench. The bench consists of 26 beds of ten retorts each, built up in two tiers, five retorts high. The retorts are 22 inch by 16 inch, of Ω section, and—this is particularly noteworthy—22 feet long. Each bed is heated by a regenerator furnace on the discharging side only. It was Mr. W. A. M'Intosh Valon, who, in the early days of the application of the principles of regeneration to retort-settings, preached the gospel of simplicity of construction meeting all the needs. The furnaces for the 26 settings of tens in this new retort-house are of Mr. Shoubridge's design; and we find he has eschewed those elaborate refinements of flues and so forth that are commonly met with in Continental practice. The regenerators are made with plain bricks and tiles; no special bricks being used in their construction. The simpler the construction of retort furnaces is, Mr. Shoubridge believes, the better; and the results attest solid foundation for the belief. Inspection gave complete satisfaction that regeneration was as efficient as it need be. The heats in the combustion chambers in every part of the bench examined were high and uniform; while the heat going away to the chimney was only sufficient to maintain the chimney draught.

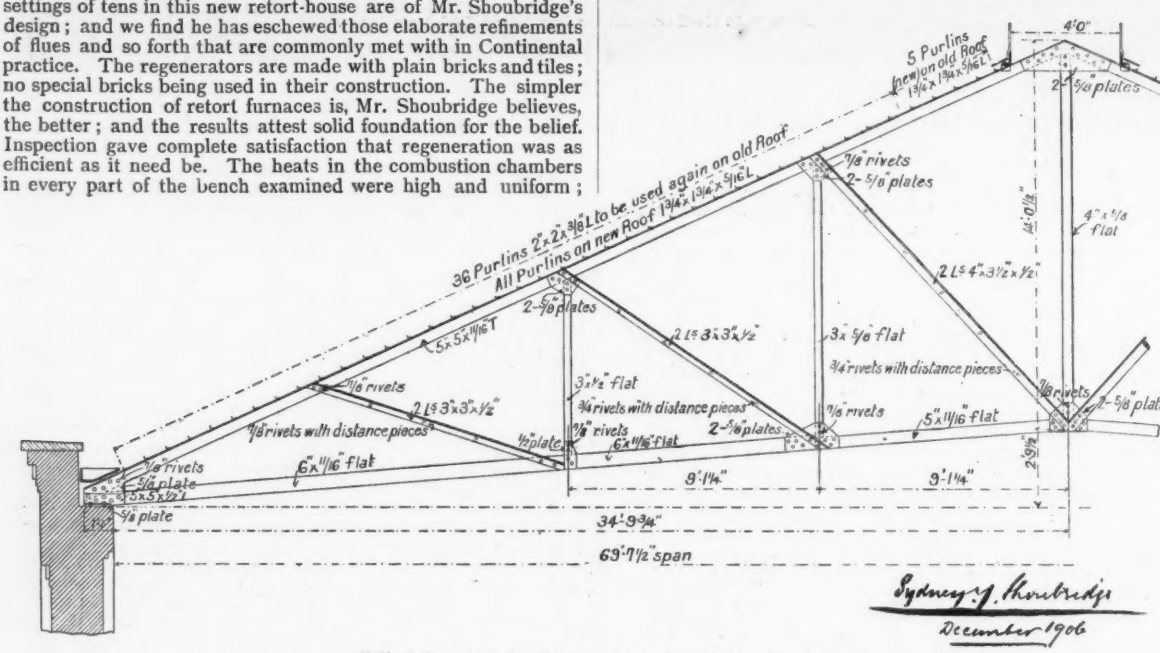
With regard to the bench-mountings, there is nothing special to say. It may, however, be mentioned that the hydraulic mains are arranged so that the tar is never allowed to accumulate in them; it being removed by the Dillamore system of tar-towers. The mains are in two-bed sections, with a separate tower to each section. The gas is taken from both ends of the retorts, through 6-inch ascension-pipes.

The Delivery of the Coal.

The coal is delivered by railway trucks into a hopper on either side of the house, whence it falls into coal-breakers below, capable of dealing with 30 tons of the hardest coal per hour. From the breakers the coal is elevated to two three-compartment hoppers, each of a capacity of 26 tons, on the charging side of the house; the conveyors being arranged so that they can be worked from either end—though one breaker and elevator is quite sufficient to supply the house. The breakers and elevators are driven by two of Messrs. William Grice and Sons' 34 brake horse power gas-engines, which also operate rams at either end of the breakers for up-ending the railway trucks, and tipping the coal. In passing, it is interesting to note that by this arrangement, the cost of delivery into the coal-receiving hopper, breaking, elevating, and depositing in the overhead hoppers has been reduced to less than ½d. per ton. The work formerly cost 2¼d. per ton. It should be mentioned that the coal is conveyed from the elevators to the



Views Showing the Method of Raising the Roof of the Old Portion of the House to the Higher Level.


5 Purlins (new) on old Roof 13¼ x 13¼ x 5/16 L
4'0"
2 - 5/8" plates
7/8" rivets
2 - 5/8" plates
4" x 5/8 flat
36 Purlins 7" x 2" x 3/8 L to be used again on old Roof
All Purlins on new Roof 13¼ x 13¼ x 5/16 L
2 L's 4" x 3½" x ½"
2 - 5/8" plates
5" x 5" x 11/16 T
2 L's 3" x 3" x ½"
3" x 5/8" flat
3/4" rivets with distance pieces
7/8" rivets
2 L's 3" x 3" x ½"
3" x ½" flat
3/4" rivets with distance pieces
7/8" rivets with distance pieces
½" plate
2½" rivets
6" x 11/16" flat
2 - 5/8" plates
7/8" rivets
5" x 11/16" flat
7/8" rivets
2 - 5/8" plates
7/8" rivets
6" x 11/16" flat
5/8 plate
5" x 5" x ½" L
5/8 plate
9'-1¼"
9'-1¼"
34'-9¾"
69'-1½" span
Sydney J. Shoubridge
December 1906

Half of One of the Principals of the New Retort-House Roof.

overhead hoppers by De Brouwer conveyors. These conveyors can be worked, as desired, to deliver into either hopper.

The De Brouwer Projector and Discharging-Machine.

Pursuing investigations beyond the hoppers, we find a change from the common practice in the adoption of the De Brouwer projector. Originally, as is ordinarily the case, where this projector is applied, there was a measuring-chamber on the machine beneath the hopper; but this was found to be somewhat of a hindrance, and quite unnecessary. It must be remembered that the settings are five retorts high; and the difficulty was that, without allowing an undue height for the machine, it was impossible to get the capacity in the measuring-chamber with sufficiently vertical sides for the coal to fall out readily. It had to be a squat sort of chamber, from which the coal would not drop freely—especially when wet, when it had something more than a tendency to clog. In Mr. Shoubridge's opinion, it does not matter much whether the charges of coal are of uniform weight or a pound or two more or less. It does not affect the production of gas; and in practice very little variation is found in the quantity put in. It is remarkable how dexterous the men get in feeding the retorts, without automatic means of measurement, with the desired weight of charge. So far as the eye could judge, and we examined several charges in different parts of the bench, they looked as much alike in thickness as one ordinary brick does to another.

To get the most economical working in connection with the mechanical charging and discharging of retorts, the machines and men, of course, require to be fully employed. Here we have a house containing 260 retorts of 22 feet length each; the projector being supplied with coal from two isolated overhead hoppers. Under these conditions, one De Brouwer projector and one De Brouwer-Jenkins discharging-machine find just about as much work to do as they can comfortably accomplish. If the house were fitted with continuous hoppers, and the time saved in running to and from the hoppers, we have no doubt from what we saw that the machines and men could, without any trouble, deal with a few additional beds. However, the machines are here operating under eminently favourable conditions to show their capability. Both the projector and discharging-machines are of the latest type with which the names of De Brouwer and Jenkins are associated. They are supported in a framework mounted on a carriage running on rails laid on the stage on the charging side. The telescopic pusher works in a very leisurely way, and without any apparent effort. It does its work quietly and effectively. With it, there has been no buckling up of charges; it has not been found to fail in this respect in the slightest degree. The reason for this is that its designers have

Photographers—Messrs. Thomson, Sydenham Road, S.E.

View of the East Side of the Retort-Bench (Showing the Scurfing Platform) in the New House at the South Suburban Gas Company's Works.

fully appreciated the character of the work it has to do, and have constructed a machine, massive and substantial, and fully equal to any demand that may be made upon it. In this house, the machine, with these long retorts, has to deal with heavier charges than is customary; and it does its work, as we can testify, without the slightest difficulty.

Regarding the projector, it has been at work since July last; and a point of inquiry was as to the repairs required. Excepting the renewal of the belt, it has claimed no consideration in the nature of repairing. The first belt with which the machine was fitted—it was one with a raised rubber path in the centre—dealt with 13,510 tons of coal before it was worn out. The price of a new belt is £11 17s. 6d.; and the cost was therefore 0·21d., or rather less than a farthing per ton of coal. This is the principal part of the machine exposed to wear; and it cannot therefore be said that the cost of repairs is excessive. If retorts are charged with the simplest of tools known for the purpose—shovels or scoops—something has to be allowed for replacements; and then there is the incomputable quantity as to the wearing effect on the men. As there is only six months' working standing to the credit of the machines, it is too early to speak with any certainty as to the wear and tear. But from what has been seen, and taking into consideration the favourable conditions under which they are working, there is no reason to anticipate that they will not compare favourably with other forms of retort-house machinery in this respect. As to the work done by the projector. At the present time, it is putting in charges of about 8½ cwt.; and, looking where we liked in this long bench, it was found that the charges throughout the 22 feet length were "well and truly laid" in respect of levelness. Although in this regard they might be equalled, they could not be excelled, by other machine or inclined working.

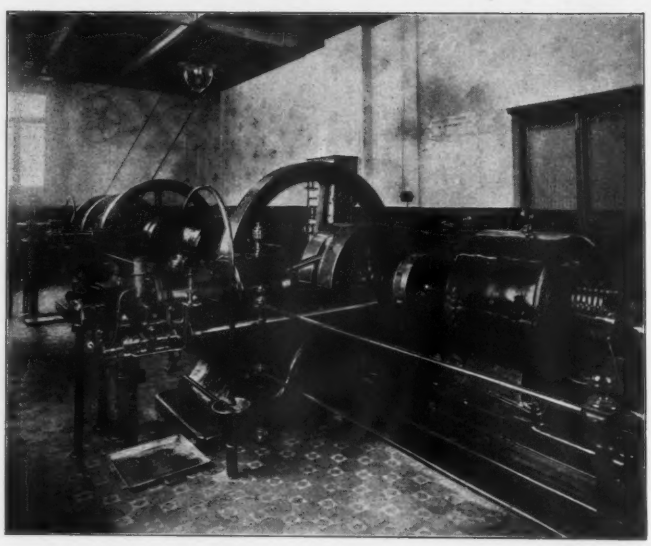
The Coke-Handling Plant.

The coke is removed from the house by a De Brouwer conveyor, 2 ft. 6 in. wide, placed on the top of the stage-floor—that is to say, it stands to its full depth above the stage-floor. This is a totally different arrangement to the one seen in many new retort-houses, where the conveyor is taken into the cellar, and the coke made to travel underneath the floor. Mr. Shoubridge's view is that, by the usual system, there is a tendency for the steam to detrimentally affect the girders of the floor. To avoid this, and to make all parts of the conveyor more accessible, he has adopted this plan of fixing the conveyor on the top of the stage (with, of course, the return passing under the stage); and in this way it answers admirably. The pushed coke falls rapidly from the retorts, and in large size. Pushing and the mechanical handling of coke go remarkably well together. With the pushing of coke, there is a minimum of disintegration. The heavy charges come tumbling out of the retorts in what almost looks like a cart-load at a time; and it travels away silently and with the greatest of ease. The coke remains upon the conveyor where it

South End of the Retort-House, Showing the Engine-House and De Brouwer Coke-Conveyor.

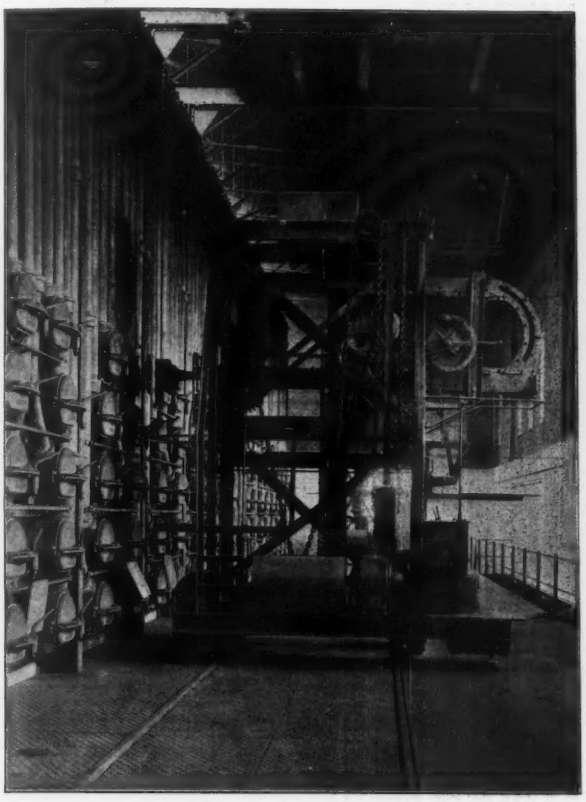
falls and is taken to its destination without rolling or attention. The quantity of breeze is, therefore, reduced to the minimum. When it is remembered that the conveyor runs, in one stretch, the full length of this 324 feet long retort-house, and for 66 feet beyond, and that the charges of coke are exceptionally large, the smoothness and the quietness of its working are remarkable.

The huge heaps of coke are partly quenched in their transit through the house by jets of water playing upon them; and the quenching is completed at the end of the house, where the coke passes through water before ascending the inclined portion of the conveyor on the outside of the house. At the end of the conveyor incline, the coke is tipped on to a jigging-screen, which removes the breeze before delivering the coke on to the yard conveyor, which is 24 feet from the ground, and has openings on the under-side for distributing the coke on the coke-heap. The length of the conveyor in the retort-house is 315 feet from the centre to the foot of the inclined conveyor; the inclined conveyor is 66 feet long; and the yard conveyor 190 feet. As this last measurement indicates, the coke-ground is an extensive one; and it is indeed required, in view of the fact that here we have a house producing about 220 tons of coke per day. On either side of the heap, there is a railway siding; the bulk of the coke being loaded into trucks, and despatched by rail.

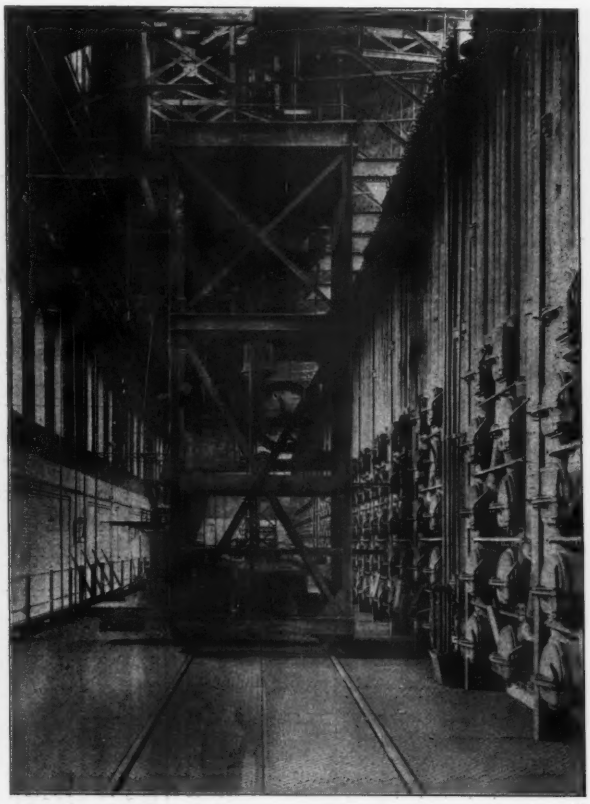


Interior of the Engine-House at the South End of the Retort-House.

View of the Retort-House End of the De Brouwer Coke-Conveyor.



The De Brouwer-Jenkins Pusher.



The De Brouwer Projector.

The Engine and Dynamo House.

The De Brouwer machinery is electrically driven. Accommodation for the engines and dynamos has been provided in a special building at the end of the retort-house, and there is interest in it. Good machinery that has important work to do deserves, where it can be obtained, proper habitation—for its preservation, and for securing from it its best work. Here the gas-engines and dynamos have got what is required. The building was constructed by the Company's men. It has a red-tiled floor; and glazed tiles are fitted all round the walls—green coloured for the dado and frieze, and cream-coloured between. The combination looks well. Besides saving the expense of re-painting or otherwise recolouring the walls, these tiles enable the man in charge to keep the place spick and span and to prevent the accumulation of dust—a condition which is so essential where there is fast-running machinery. The roof on its underside is boarded; and the windows are large, so that the place is well lighted by day. By night, high-power gas-lamps are in use. For an engine-house the building is well conceived, and its inspection gives pleasure. Such surroundings also give encouragement to the attendant to maintain the machinery under his charge bright and clean, and in the best running condition.

As to the contents of the house. There are three gas-engines (all of Grice's make); one of them being of 34 brake horse power for driving the coke-conveyor. The other two which are of 42 brake horse power are for driving the De Brouwer projector and discharging-machine. One is sufficient for the work; the other being kept in reserve. Flexible couplings connect these engines direct to two Lancashire dynamos, capable of developing 20 kilowatts, at 220 volts, when the engines are running at 230 revolutions. There is ample margin of power, as was shown by a test made when the projector and discharging-machine were fully at work. It was found that they required only 13 to 15 horse power to work them. The house, of course, is equipped with the necessary switch-board, with the voltmeters, ammeters, fuses, and cut-outs mounted on a handsome marble slab.

Returning for a moment to the gas-engines, it was noticed that, to one of the engines, in place of the usual flame igniter tube, an electrical igniter, actuated by a small battery and accumulator, has been fitted. We were informed that this improvement, devised and fitted by one of the engine drivers, not only causes the engine to work more smoothly and with less shock but that it effects an appreciable economy in the consumption of gas.

The Total Cost.

The total cost of the work we have described—comprising the conversion of a 200 feet by 70 feet wide house into one 324 feet long by 70 feet wide, with the raising of the walls and roof 17 feet in the case of the old portion, together with the complete equipment of the house with 26 regenerator settings of ten retorts each, with coal and coke handling plants (including the yard coke-distributing plant), and with De Brouwer charging and discharging machines—was £37,864. This is a very moderate sum; but it must be remembered that all the serviceable bricks from the old bench were used in the new bench, that the ordinary stock bricks and stone and the roof were made on the works, and that the Company's men did all the building and erection, with the exception of the plant supplied by Messrs. W. J. Jenkins and Co., Limited, who were the only contractors employed. The house is equal to producing 4 million cubic feet per diem, and is a very welcome addition to the manufacturing power of the works.

Whitewashed Walls and the Lighting of Schoolrooms.

A short note by Herr F. Uppenborn has been reprinted in the "Journal für Gasbeleuchtung" from the Proceedings of the "Vereinigung der Elektrizitätswerke," in which the author has described some measurements he made of the illumination in different positions in a schoolroom in Luisenstrasse, Munich, at a time when the walls and ceiling were soiled, and again immediately after they had been whitewashed. The schoolroom in question was a rectangular apartment, roughly 37 ft. 6 in. long, 26 feet wide, and 13 feet high. It was provided with indirect illumination from four electric lamps disposed symmetrically in the room; each lamp being approximately 9 feet distant from the short ends, and 6 ft. 6 in. from the long sides. The lights hung 3 ft. 4 in. below the ceiling. The ends and one side of the room were essentially plain whitewashed walls, and the other long side consisted almost entirely of windows. Measurements of the illumination were made in eighteen different positions, in three parallel rows of six positions each; the central row of observing positions coinciding with the major axis of the apartment, and the two side rows being vertically under the lamps. The figures have not been converted into British measurements, as interest in the matter is purely comparative.

	Before Whitewashing.	After Whitewashing.
Mean illumination	39·7 Lux	67·4 Lux
Maximum ,,	56·5 ,,	83·8 ,,
Minimum ,,	24·1 ,,	50·1 ,,
Maximum divergence from mean	−39·3 p. ct.	−25·7 p. ct.
	+42·3 ,,	+24·4 ,,
Ratio of mimimum to maximum illumination	0·43	0·60
Consumption of electricity, in watts per square metre per Lux	0·484	0·289

It will be seen that the average amount of illumination at the eighteen observing stations was increased by the fresh coat of whitewash from 39·7 to 67·4 Lux—*i.e.*, had risen by about 70 per cent.; also that the maximum divergence from the mean illumination had decreased from about 42 to about 26 per cent.

TESTS OF VARIOUS ILLUMINANTS IN VIENNA.

We recently received, through the Secretary of the Imperial Continental Gas Association (Mr. Robert W. Wilson), a most interesting comparative table as to different sources of light under the conditions of price, &c., prevailing in Vienna. It is a copy of one compiled last year by a Committee of the Austrian-Hungarian Society of Gas Engineers, with the exception that Mr. A. R. Egeler, the Association's Engineer at Vienna, has added to it the results he obtained with the "Graetzin" gas-lamp, which had not been tried by the Committee. The whole of the figures have been converted into English measurements on the basis stated at the foot of the table.

Writing to Mr. Wilson, in reference to the tables and the accompanying diagram, Mr. Egeler says: "The table shows the Hefner-Kerzen power of divers sources of light, which can be obtained in Vienna for one krone in one hour. The Graetzin lamp, however, was not included. We had it put upon the list and added to the diagram, with the gratifying result that it beats all the other lamps and burners."

Comparative Table of Different Sources of Light in 1906 under the Conditions of Price, &c., Prevailing in Vienna.

Source of Light.	Illuminating Power.		Hourly Consumption.		Heat Evolved per Hour. Large Calories.		Carbonic Acid Evolved per Hour. Cubic Feet.		Cost of Maintenance. Pence per Hour.		Light Obtainable for One Penny per Hour.
	Hefners.	Candles.	Total.	Per Candle.	Total	Per Candle.	Total.	Per Candle.	Total.	Per Candle.	Candles.
Candles—											
Wax	1·00	0·91	106·40	117·10 grains	65	71·50	0·39	0·431	0·414	0·455	2·2
Stearine	1·09	0·99	132·40	133·50 ,,	75	76·00	0·46	0·462	0·164	0·166	6·0
Paraffin	1·35	1·23	130·60	106·40 ,,	87	70·50	0·51	0·416	0·122	0·112	8·9
Composition — ⅔ Paraffin, ⅓ Stearine	1·23	1·12	131·70	117·70 ,,	81	72·50	0·49	0·443	0·144	0·128	7·8
Oil lamps—											
Rape oil, loose wick	0·80	0·73	117·50	161·70 ,,	72	99·00	0·40	0·555	0·073	0·1005	9·9
Moderator, purified oil	10·95	9·95	556·00	55·80 ,,	342	34·00	1·91	0·190	0·346	0·03475	37 9
Petroleum, circular burner	13·20	12·00	673·00	56·00 ,,	480	40·00	2·47	0·206	0·192	0·01595	62·7
Spirit lamp—											
With incandescent mantle	42·90	39·00	1991·00	51·10 ,,	698	18·00	4·20	0·107	0·553	0·01420	70·4
Gas—											
Batswing burner	20·00	18·20	9·39	0·517 cub. ft.	1,330	73·00	4·88	0·269	0·505	0·02780	35·9
Argand	20·00	18·20	7·06	0·388 ,,	1,000	55·00	3·67	0·202	0·380	0·02090	47 8
Regenerative	530·00	482·00	81·20	0·167 ,,	12,190	25·30	42·25	0·087	4·370	0·00902	111·0
Ordinary Welsbach	70·00	63·60	4·24	0·0664 ,,	600	9·50	2·23	0·035	0·228	0·00352	284·0
Lucas	411·00	374·00	22·25	0·0594 ,,	3,150	8·60	11·72	0·031	1·197	0·00319	313·2
Millennium (high pressure)	1060·00	964·00	42·40	0·0439 ,,	6,000	6·35	25·55	0·023	2·280	0·00231	433 0
Graetzin	110·00	100·00	3·18	0·0318 ,,	450	4·51	1·68	0·017	0·171	0·00165	584·5
Electricity—											
Edison lamp	34·60	31·45	104·00	3·31 watts.	90	2·86	0·00	..	0·728	0·02320	43·1
Osmium	31·40	28·55	48·70	1·70 ,,	42	1·47	0·00	..	0·341	0·01188	84·2
Tantalum	25·00	22·75	38·50	1·69 ,,	42	1·47	0·00	..	0·270	0·01188	84·2
Nernst	113·00	102·70	213·00	2·06 ,,	184	1·79	0·00	..	1·491	0·01452	68·8
Arc	400·00	364·00	440·00	1·21 ,,	380	1·04	0·38	0·00105	3·080	0·00847	118·0
Bremer (flame-arc)	1880·00	1710·00	440·00	0·257 ,,	380	0·22	0·74	0·00043	3·080	0·00176	568·0

The prices of illuminants in Vienna, on which the last three columns of the table are based, are as follows.

Candles.—Wax = 6·00 kronen per kilo. = 2s. 3½d. per lb.
Stearine = 1·92 ,, ,, = 0 8·7 ,,
Paraffin = 1·44 ,, ,, = 0 6½ ,,
Composition = 1·68 ,, ,, = 0 7·6 ,,
Petroleum.—Spec. gr. 0·815 = 0·36 ,, per litre = 1 4½ per gall.

Oil.—
Rape and moderator lamp = 0·96 krone per kilo. = 0s. 4½d. per lb.
Spirit.—Spec. gr. 0·840 = 0·36 krone per litre = 1 4½ per gall.
Coal gas.—19 heller per cubic metre = 4 5½ per 1000 c. ft.
Electricity.—7 ,, ,, hectowatt hour = 0 7 per B. of T.U.

Note.—In converting the foreign units of the original table into English units, the Austrian krone, or crown, of 100 heller has been taken as equal to 10d., and the Hefner as equal to $\frac{9}{10}$ English standard candle (see "Journal," Vol. XCV., p. 102).

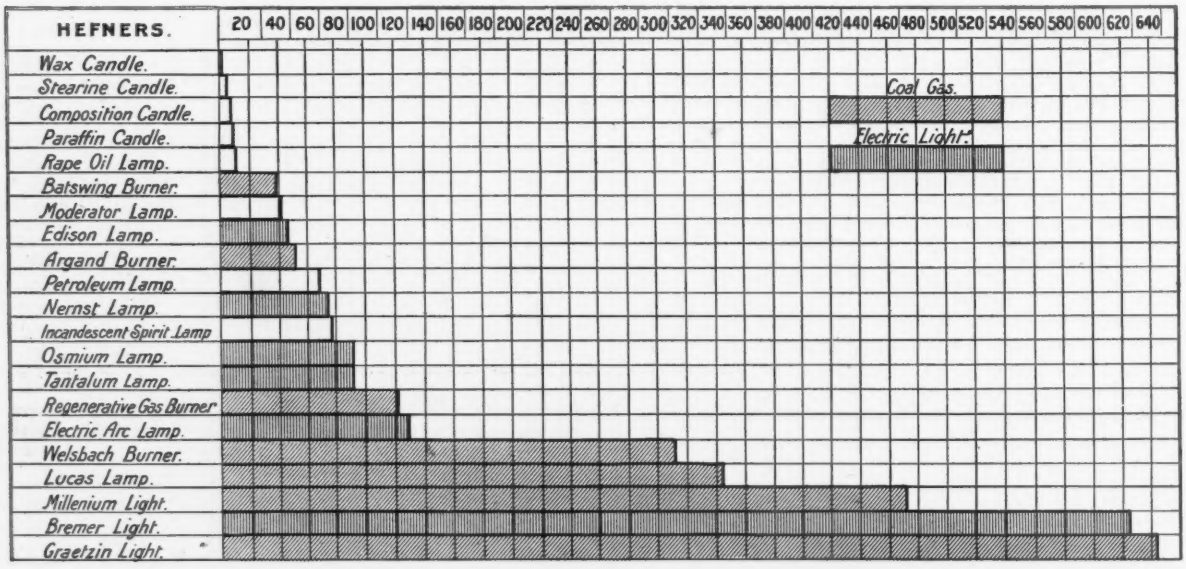


Diagram Showing the Light Obtainable for One Penny an Hour in Vienna.

The operation of the Philadelphia filters during 1905 cost on an average $4·13 per million gallons of water filtered, exclusive of that used in transporting and washing sand. The average cost per million gallons to scrape, transport, wash, and restore sand to the beds was 79 c. at the Lower Roxborough, 63 c. at the Upper Roxborough, and $1·25 at the Belmont station. The high cost at Belmont is due to the fact that the applied water carries more suspended matter. It receives an average of only 2½ days' sedimentation; while at Lower Roxborough it receives a day's sedimentation and is treated by preliminary filtration, and at Upper Roxborough about 15 days' sedimentation. The average amount of sand removed per million gallons of water filtered was 0·88 cubic yard at Lower Roxborough, 0·8 cubic yard at Upper Roxborough, and 1·57 cubic yards at Belmont.

CHURCH LIGHTING FROM THE CAMERA'S POINT OF VIEW.

St. Michael's Church Heavitree, Exeter, as Illuminated by "Nico" Inverted Gas-Burners.

How to properly light a church is a matter of great importance at the present day. The "dim religious light" of the past—which was regarded as correct, and tolerated not really so much because it befitted the sacred buildings and worship, but because the systems of lighting then existent were not by any means the best suited for dealing with the unfavourable conditions—is a thing that lives only in history. That the latter is the real reason for the past poor illumination of churches is clear from the fact that as soon as suitable means of lighting were provided, that converted the sombre (under imperfect lighting conditions) interiors of churches into places of brightness and beauty, they were, and are still being, in many cases eagerly taken advantage of by church authorities. The change is emblematic of the service the church itself renders to humanity.

Generally speaking, the architectural characteristics of churches do not offer any great facilities to the lighting engineer to get good and uniform illumination throughout the building. The high dark-stained wood lined and supported roofs do not aid reflection, and the shadow-casting pillars and arches down the naves, instead of being of assistance, are rather obstructive. Churches, however, are not built to fit the artificial lighting; the artificial lighting is a subsidiary matter, and must be arranged to fit the church. Therefore we have certain rigid conditions that have to be considered and dealt with in the best possible manner in any scheme of illumination. In the first place, the sight-straining light of olden days must be abolished. The primary object of lighting is to enable the worshippers to read none too convenient sized print; and therefore there must be uniform downward illumination without heavy shadows of any kind. Under these circumstances, lights of too great power must not be used; but they must be fairly frequently spaced and of medium illuminating powers. At the same time, the upper part of the church ought not to be lost in gloom. There are many churches whose upper architectural features are very beautiful, and though men and women do not, as a rule, attend church to study architectural design, there is no reason why that which is beautiful should be shut from their sight while engaged in worship. We have moved far from the puritanical belief in worship and beauty of surroundings being inconsistent. In securing such illumination, the inverted gas-burner is an admirable aid.

A great deal has just recently been said about the use of inverted gas-burners in churches; but it must not be supposed that, because of this, the application of such burners in the illumination of places of worship is something new. It is, as a matter of fact, quite three years ago that the burners of the New Inverted Incandescent Gas-Lamp Company, Limited, were applied to the purpose; and since then the work of installing them has been proceeding in many parts of the country. And this is worthy of remark, that during this very considerable experience there has been no complaint of trouble with the burners. In Bristol alone, there have certainly been at least two installations in churches going throughout the past two years; and the good reputation they quickly made for themselves has not diminished with time. Among the more recent introductions of the Company's latest forms of burners—the "Nico"—are those that have been made in Exeter churches; the installations having been carried out not by the New Inverted Company, but by the Exeter Gas Company. Here is reproduced a photograph of the interior of one of the churches, taken when the lamps were alight. We have heard a lot about "faked" photographs—even those who are not photographers will understand the "soft impeachment" that the word conveys. The photograph of St. Michael's Church, Exeter, has been carefully examined; and we are perfectly satisfied as to its *bona fides*. We should like to point out to those who are guilty of the art of "faking," that strong lights taken at a distance in large interiors do not show on the negative (according to our experience) a well-defined lamp, or (when a print is taken) a very white spot of light standing out with the definiteness of a star in the sky. On the negative the radiations from strong lights, if the photograph is properly taken, show as a cloud, which (when printed) is reproduced as something very much like a localized white mist. The church of St. Michael's is lighted by 30 No. 4 "Nico" burners, and 24 bijou ones. The latter are fixed on the pillars and side brackets in the sanctuary; and the former are used for the lighting of the choir and nave by brackets, as shown in the photograph. The vicar and churchwardens have expressed great satisfaction with the result; and this is not surprising even when judgment is based only on the photographic evidence. Look at the photograph, ignore the white mists, showing the location of the lights, and see what the surroundings tell of the character of the illumination. There is uniform lighting over the whole of the pews. The church is one containing beautiful architectural work; and the photograph disposes of the idea that with inverted gas lighting the beauties of the upper part of a large building are lost in darkness. The graceful lines of the arches, and the beautiful sculptural details of the masonry, are brought out with pronounced relief, and the altar is visible in every detail. The whole effect is evidence of really admirable arrangement and suitability.

The Exeter Gas Company have also fitted St. James' Church with inverted lamps. In this scheme, 86 No. 4 "Nico" burners and 24 of the bijou type are employed. Four of the pendants in this case are fitted with six burners each, to which auto-igniters are attached; the bye-passes being operated from a point near the meter. The Rector describes the lighting as excellent.

More convincing testimony than is afforded by these installations as to the applicability of the inverted gas-light to church illumination, and the satisfaction given to the church authorities, could not be obtained. The point of view of the camera also aids one to appreciate what is required and what to avoid in the lighting of such buildings.

INDOOR ILLUMINATION.

The November issue of the "Transactions" of the American Illuminating Engineering Society has recently come to hand, and contains some interesting matter for those more immediately concerned with the lighting of interiors. The report consists of two papers—one on the "Application of Photometric Data to Indoor Illumination," by Mr. E. C. White, of Winnipeg, and the other entitled "Data on Indoor Illumination," by Mr. J. E. Woodwell, of Washington—and includes the discussions which followed their presentation at meetings of the Society.

Mr. White, in introducing his subject, points out that the most important branch of illuminating engineering work lies in the application of photometric curves of lamps and their accessories to the requirements of practical illumination, but suggests that the ordinary polar diagram and the law of inverse squares are not merely clumsy for rapid work but liable to misleading results if used by persons not appreciating the actual phenomena which they represent. Curves of uniform illumination are advanced as the simplest device for graphical calculation yet provided for the application of distribution data to the design of illumination. These curves are simply polar diagrams representing the distances in all directions at which equal illumination is produced by the source for which the curve is plotted. Marginal scales are provided which read in feet for various intensities of illumination—that is, foot-candle values.

The object of the paper is to advocate the use of this system; and the author gives several diagrams of curves plotted for 16 and 32 candle power electric lamps, and incandescent gas-burners, both upright and inverted. The curves are shown on diagrams of concentric rings, all of which, counting from the centre, denote feet and fractions of feet; and by means of the scales, one can read off the distance at which varying foot-candle values are obtainable. Mr. White, in drawing attention to the advantages of equal illumination curves, remarks that their shape represents the effect produced, and not merely the cause; and that they afford instant reference to the best location of lights. An example of the use of the method is found in the illumination scheme of a dining-room; and this the author describes and illustrates.

In the second paper—"Data on Indoor Illumination"—Mr. Woodwell points out that illuminating engineering, having for its basis the physical laws of light which are subject to rigorous mathematical demonstration and calculation, depends nevertheless upon many other important factors tending to modify the application of fundamental principles and formulæ. It involves a study of the character, colour, and intensity of artificial illumination; the type, number, and position of radiants or light sources; kind of accessories; and, finally, the resultant optical, physiological, and æstbetic effects. The final criterion of satisfactory illumination is not a definite intensity as expressed in foot-candles, but a visual effect or physiological sensation incapable of quantitative expression.

Quantitative measurement of illumination is not therefore to be wholly relied upon as the basis for calculation. The paucity of data determined by actual illumination tests of every variety of indoor conditions makes it necessary to approximate general values for the intensity upon the basis of judgment and experience. It is known, for example, that one foot-candle is sufficient to enable one to read ordinary print (small pica) comfortably; while for newspaper print at least 2 foot-candles is desirable. For desk illumination, 2 foot-candles is generally sufficient; though for detail work 3 and even 4 foot-candles have not been found excessive. For corridors, public spaces, and assembly rooms, the figures range from 0·5 to 1·5 foot-candles; while in stores where dark goods are displayed or a brilliant effect is desired, 5 to 10 foot-candles is not uncommon. The latter amount is also required for tracing, drafting, engraving, and other similar work. These intensities refer to the working plane. Consideration must, in addition, be given to the walls and ceiling and objects in the space to be illuminated; and the figures determined upon for this purpose will depend principally upon the colour and reflection values of such surfaces.

Without discussing the choice of the illuminants themselves, the author then deals with such peculiarities or characteristics as affect their use. In order to ascertain what may be accomplished with a given light, it is necessary to know its distribution curve, including that of any requisite accessory.

The distribution is generally shown on a polar diagram, an example of which is given in the paper. Fig. 1 shows such a curve for an unshaded 16-candle power electric lamp, and also the distribution obtained from the same lamp by two prismatic shades. Such curves are of great value to the illuminating engineer; but unless the underlying principles are kept well in mind, deductions from a comparison of such curves for lamps and reflectors of different types are apt to be misleading to the layman.

To illustrate this point, let A (fig. 2) be a light source of the uniform intensity of 1 candle in all directions. Its curve of distribution in any given plane will obviously be shown by a circle; while the total flux of light from the source is represented by a sphere whose radius is 1 unit. Now if it is assumed that, by means of a reflector, the intensity throughout a zone generated by the arc B C subtended by the angle B A C of (say) 15° below

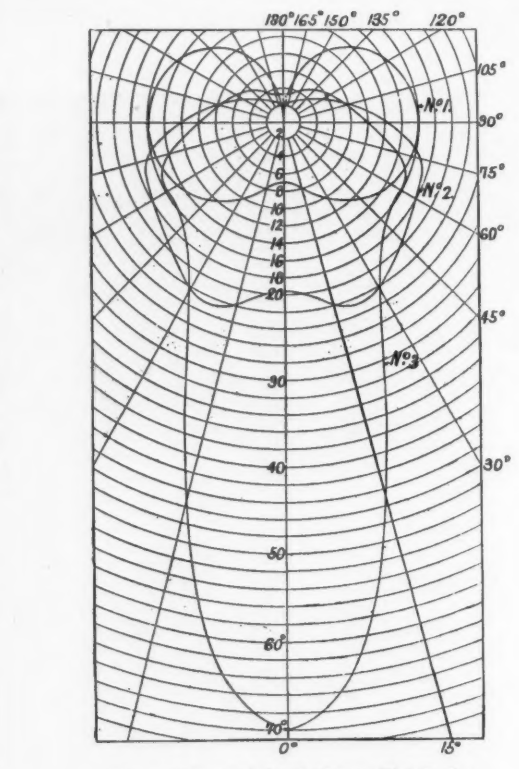


Fig. 1.—Curves of Candle-Power Distribution.

No. 1 Curve—16-candle power bare lamp. No. 2 Curve—Same lamp with distributing reflector. No. 3 Curve—Same lamp with concentrating reflector.

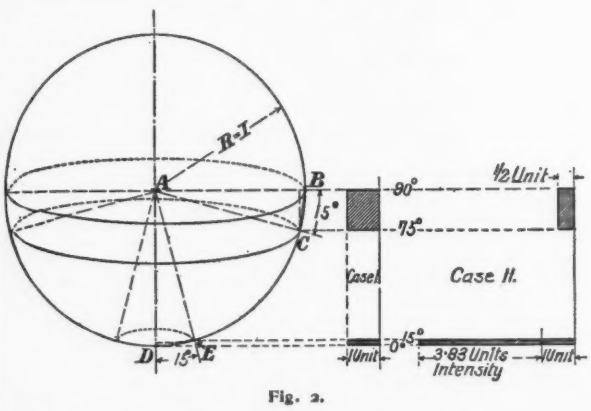


Fig. 2.

the horizontal plane, is reduced one-half, the intensity over this area will remain one-half candle. If the flux of light borrowed from this zone is now re-directed vertically downward within the same angle of 15°, then the average intensity of the zone generated by the revolution of the arc D E about the vertical axis will be increased to

$$1 + \frac{\frac{1}{2} \times \text{area of zone generated by arc B C}}{\text{area of zone generated by the arc D E}} = 4{\cdot}83,$$ as shown

graphically in Case II., fig. 2; the ratio of the areas of the two zones being approximately 1 to $7\frac{3}{4}$, as shown in Case I., fig. 2.

It is evident that a very small quantity of light borrowed at or near the horizontal may be made to enormously increase the intensity in the downward direction. The polar diagram which shows only the radial intensities does not, therefore, correctly indicate the change in flux of light at various angles. The prismatic shades giving the polar distribution as shown by Curves 2 and 3, fig. 1, for example, are of practically equal efficiency; but No. 2 appears to a decided disadvantage in the comparison. For general purposes, however, No. 2 would prove the most desirable and satisfactory reflector. To show this properly, recourse must be had to the Rousseau diagram, which is constructed as shown in figs. 2 and 3 on the theorem in solid geometry that the area of a zone is equal to its altitude multiplied by the circumference of a great circle. The surface of various zones, and consequently the illumination thereon, is thus proportioned to the respective altitudes; and if the altitudes of the zones included between the various angles are laid off by projection as shown in fig. 3, and the candle power at each radial line plotted thereon, the total illuminating power of a source of light will be proportional to the area enclosed by the Rousseau curve, and the flux of light through any zone will be correctly shown. The Rousseau diagram is essential to a proper comparison of the performance of various reflectors.

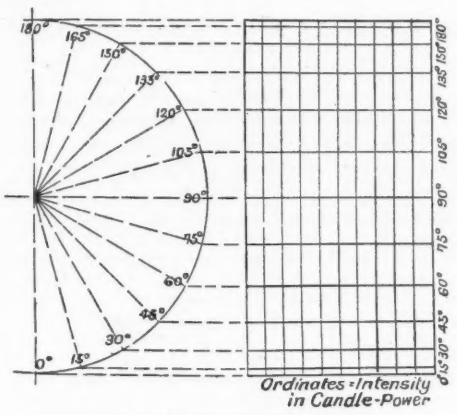


Fig. 3.—Rousseau Diagram.

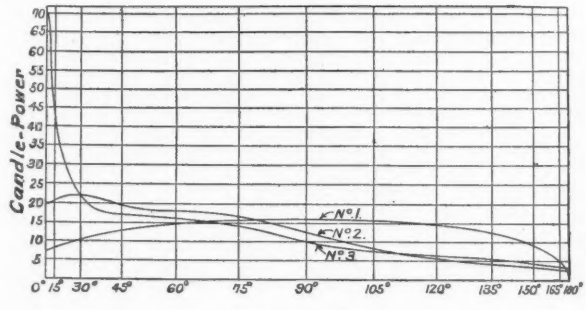


Fig. 4.—Rousseau Diagram.

No. 1 Curve—16-candle power bare lamp. No. 2 Curve—Same lamp with distributing reflector. No. 3 Curve—Same lamp with concentrating reflector.

Fig. 4 shows a Rousseau diagram of the bare 16-candle power oval anchored, carbon filament lamp, and the same lamp with the two prismatic reflectors which are comparable with the polar diagrams shown in fig. 1. Here the volume or flux of light below the horizontal or between 0° and 90°, as represented by the area below the curve, is clearly shown to be about the same for Reflector No. 2 as for Reflector No. 3. The effect of both reflectors in redirecting the light of a bare incandescent lamp from the upper to the lower hemisphere is also clearly shown. The difference between the area below the curve of the reflector and that of the bare lamp should properly show the absorption of light in the material of the reflector, and any other losses; this being a measure of the efficiency of the shade.

The author next proceeds to describe the usual method of determinating the quantity of light falling upon a given surface by the law of inverse squares, expressing the illumination in foot-candles. The use of Lambert's cosine law is also shown for cases where light rays strike the plane at an angle. The computation of the value of the lighting effect in foot-candles is illustrated by an illumination curve of a 32-candle power Tantalum lamp and prismatic shade located 5 feet above the horizontal plane to be illuminated. Mr. Woodwell remarks that the law of inverse squares does not hold for light sources of appreciable size, such as the Moore tube and the Cooper-Hewitt lamp; the actual deviations being considerable even in the cases where large diffusing globes are used.

The radiation from a cylindrical source has been investigated by Dr. E. P. Hyde, of the United States Bureau of Standards, in connection with the use of a Nernst glower as a light source in certain photometric tests showing the necessity in refined work of taking into account such errors as are likely to occur from a deviation from the law of inverse squares. The radiation from a cylinder of infinite length varies in intensity inversely as the distance from the axis of the cylinder; and in practice this law is approached in the application of the Moore tube. The Cooper-Hewitt lamp is far from a point source; but at distances long compared to the length of tube its radiation approaches the law of inverse squares, while at comparatively short distances it is nearly proportional to the distance.

In the foregoing, no account has been taken of the effect of the reflection. Illumination is frequently very materially increased by diffused reflection from walls and ceiling; the amount being dependent upon the distance of the light source from the reflecting surface and the coefficient of reflection. The increase in illumination due to reflection is small in the case of dark walls or large rooms; but with small interiors having white painted or similar walls and ceiling, the direct illumination may be increased two or even three times. The theoretical constant is computed by the formula $K = \frac{1}{1 - C}$, where C = coefficient of reflection of the walls or surfaces. For relatively large interiors and light-tinted walls and ceilings, the values of $\frac{1}{1 - C}$ will be found to lie generally between 1·25 and 1·50. In planning a system of illumination for a new building on which the colour scheme is not determined, very little allowance can safely be made for reflection; but where, with a view to economy, the finish of walls and ceilings is planned to take advantage of reflection, the resultant illumination may by this means be more than doubled.

Mr. Woodwell next deals with the important question of the intrinsic brilliancy of the light source. With recent developments in arc and incandescent lighting has come a corresponding increase in intrinsic brilliancy, so that it is necessary either to shade such lights or to keep them entirely out of the field of vision. The physiological effect of a light source of high intrinsic brilliancy within the field of vision is to so reduce the pupillary aperture that the normal sensibility of the eye is greatly impaired. The author furnishes the following table of the intrinsic brilliancy in candle power per square inch of a number of common light sources:—

Moore tube	½ to 1½
Gas arc lamp	1 to 2—alabaster globe
Candle	3 to 4
Cooper-Hewitt lamp. .	3 to 6—approximate
Incandescent, frosted .	2 to 8—dependent upon efficiency and style of build
Kerosene oil lamp . .	3 to 8
Gas-mantle burner . .	20 to 25—unshaded
Acetylene flame . . .	75 to 120
Enclosed arc	100 to 200
Incandescent lamp . .	100 to 300—bare
Nernst lamp	800 to 1000—bare

As a brilliancy in excess of 5 or 6 candle power per square inch produces retinal fatigue and irritation, it will be seen that the most common illuminants require shades or enclosing globes if placed within the field of vision. Even where illuminants of great brilliancy are located out of the field of vision, care must be taken to avoid regular reflection from objects to the eye, as light of comparatively low intensity entering the eye at an unusual angle is quite as detrimental as excessive brilliancy in the direct line of vision.

The author devotes the remainder of his contribution to practical work, giving descriptions of several illumination schemes carried out by himself and others in the States, in which regard has been paid to the fundamental principles of illumination dealt with in his paper. In the case of the class and lecture room of the Y.M.C.A. building, Washington, between 2 and 3 foot-candles illumination was provided on a horizontal plane 30 inches above floor level. No allowance was made for reflection, in consequence of the existence of blackboards on one side of the room and the uncertain colour value of the walls. The number and position of light sources were arranged so as to avoid shadows and to obtain uniform illumination over the working area. The diagram submitted by him shows two excellent foot-candle curves superimposed transversely and diagonally over a plan of the room.

Incidentally, in describing and criticizing various other schemes (which, because of their local character, it is here unnecessary to detail), the author refers to the four-light gas arc lamp as being successful for general illumination by reason of its low intrinsic brilliancy. The efficiency of a four-light gas arc lamp with reference to its total flux of light has been shown by test to be less than that of four individual incandescent burners, due to the interference of light from the group of four burners in the arc. The inverted burner is particularly efficient and satisfactory for postal and other work-room illumination, since a large proportion of light falls below the horizontal—67 per cent., compared with 45 per cent. of the upright incandescent gas-burner. In concluding, the author suggests that the subject is too comprehensive to be dealt with in a single paper.

The discussions which followed the reading of the two papers at the several sectional meetings were in part devoted to the various examples of actual illumination schemes executed or referred to by the authors; but the purely technical portion is briefly abstracted as follows.

At the New York Section, Dr. A. H. Elliott emphasized the great importance of the distribution of light as compared with its intensity. He suggested that pure plaster of paris, which reflected 80 per cent. of the light, would serve as a good distributing agent if the light rays were allowed to strike upon its surface, and that this would be preferable to having an intense light which has to be toned to the extent of 15 to 50 per cent. by glass. Dr. C. H. Sharp stated that it is not sufficient in all cases to consider the illumination on the horizontal plane in a room. The horizontal rays illuminating the vertical and also illumination on the normal plane, as in the case of reading, have to be taken into account.

At the New England Section, Dr. Louis Bell, in referring to Mr. White's curves of equal illumination, stated that he personally finds the ordinary polar diagram and slide-rule a very convenient combination for measuring illuminating effects, but that some people might think the curves described were easier of application. The speaker also calls attention to the undue importance attached in Mr. Woodwell's paper to the law of cosines, and pointed out that nearly all the light used in reading or for ordinary purposes is normal in character—the book or paper being generally so placed that very little oblique light is utilized. The same thing applies to outdoor work; street lighting is concerned more particularly with objects projecting from the surface where normal illumination is of value. In dealing with the question of the illumination of a room by a number of lights, Dr. Bell says there is no satisfaction in trying to make a deliberate and complete

integration of their lighting effect; and it is easier to calculate the illumination from the nearer lights and neglect that from the distant ones, since some of the latter cannot simultaneously fall upon the work, and others may be cut off. The speaker later on remarked that in the Rousseau diagram the principal thing is merely to give a diagram of areas which represent quantities of light thrown out in different zones. It is very valuable for one special purpose—and that is for furnishing a quick way of integrating the total flux in various directions. As the polar diagram is as easy to make and equally easy to figure from, it is entirely adequate, and will continue to be the one in general use. The Rousseau can be directly derived from the polar diagram, should it be necessary to show the absorption by a given shade, and thus get at the actual loss of light.

THE NESTLER GAS-FINDER.

In a recent number of the "Journal für Gasbeleuchtung," Herr T. Hahn, of Kötzschenbroda, describes the apparatus constructed by Herr C. Nestler, of Lahr, in Baden, for locating a leak in underground gas-mains, and also some improvements he has made in the apparatus, with the object of rendering it even more trustworthy and sensitive.

The Nestler gas-finder consists of a portable upright stand carrying a suction pump worked by hand, with the aid of which a current of air, or air and gas (if there is a leak), is aspirated through flexible tubing from a standpipe inserted in a hole previously made in the ground in the neighbourhood of the spot where leakage is suspected. On its way to the pump, the air is forced through two small filters to extract dust or sand. From the pump the air travels through a tube, which is constructed of glass, so arranged that a piece of filter-paper moistened with palladium chloride is exposed to its action. Afterwards the air passes to a rubber bag and also to a burner, where the presence of gas in the air aspirated can be detected by applying a light. The lower part of the pipe that descends into the ground is perforated, and it is made tight at the surface of the soil with a suitable plug of damp clay. The instructions given with the apparatus are that the filter-paper shall be treated with a 10 per cent. solution of palladium chloride by means of a spraying apparatus.

The first experiments carried out by Herr Hahn with the Nestler gas-finder were entirely unsatisfactory—the paper prepared in the prescribed manner failing to show the presence of gas; but he has found that perfectly good results can be obtained if the apparatus is modified as follows: The pipe leading from the pump is made to point in a downward direction, terminating about half-an-inch above a small level table fixed to the upright stand. On this table a piece of white paper, measuring about 3 in. by 2 in., is laid, being held in position by a 1-inch ring of glass, which can be momentarily lifted when necessary, and which also prevents the gas issuing from the tube being blown away by the wind. The operator carries in his pocket a corked bottle of palladium chloride solution. He inverts the bottle, and applies to the centre of the piece of paper the drop of liquid clinging to the cork. When the pump is worked, the current of air is thus brought into intimate contact with the reagent in a liquid state, and discoloration then occurs instantaneously if gas is escaping from the main under test. The whole operation only takes a few seconds, and 100 grammes of the palladium solution will last for a year. When the used papers have accumulated sufficiently, the palladium in them can easily be recovered.

From Non-Statutory to Statutory Condition.

We learn that a guarantee fund has been formed by several gas companies in order to test the claim of the Inland Revenue Commissioners for stamp duty when a limited company obtains parliamentary powers, and the property is vested in the statutory company, and that the case will shortly come before the Courts. Messrs. Batten, Proffitt, and Scott, of No. 32, Great George Street, S.W., are Solicitors for the interested companies; and they have retained as Counsel Mr. C. A. Cripps, K.C. Mr. F. Paternoster, of the Felixstowe Gas Company, has been indefatigable in promoting this matter; and from him any information can be obtained by interested companies.

Distinctions Conferred upon German Gas Men.

In connection with the opening ceremony of the new German Museum at Munich, on Nov. 13, the German Emperor conferred a number of distinctions upon scientific and technical men who had taken an active part in its equipment. Among those honoured in respect of the gas and lighting sections may be mentioned Dr. A. Slaby, of Charlottenburg, on whom the Order of St. Michael in the second class, with star, was conferred; Dr. W. von Oechelhaeuser, of Dessau, and Professor H. Rietschel, of Berlin, both of whom received the distinction of the Order of St. Michael in the second class. The same Order in the third class was conferred upon Dr. Wilhelm von Siemens, of Berlin, Herr P. Langen, of the Deutz Gas-Engine Works, Dr. T. Peters, of Berlin, and Herr R. Diesel, of Munich.

AN AMERICAN MUNICIPAL GAS PLANT.

At the last Annual Meeting of the Pacific Coast Gas Association, a paper was read by Mr. C. E. Moore, in which he gave the following account of his personal experiences with the municipal gas plant in the town of Santa Clara, in California. As this is the only municipal plant, so far as the writer was aware, on the Pacific coast, his story is of special interest.

There is nothing remarkable about this plant, except the fact that it is owned and operated by the Municipality. The writer has for several years been acting as Consulting Engineer for the town, and in this capacity had charge of the construction of the water and electric lighting plants which preceded the gas plant. When gas was taken up, it naturally followed that the same arrangement was continued. It will therefore be understood that the Engineer as well as the Municipal Council had much of the gas business to learn. However, having been identified with the enterprise since its establishment, and continuing at present to be in touch with it, and since the plant occupies rather a unique position, it has seemed that a brief account of its career may be of interest. The account will naturally fall somewhat into the line of a discussion of municipal ownership; but this will not be with the object of establishing any extreme views, but rather with the idea of drawing such inferences as are possible from our experience. Regarding the broader question of general municipal ownership, the writer has come in contact with it in many other places, and inevitably his views are somewhat coloured by the sum-total of all this experience; but the effort will be made here to confine deductions as strictly as possible to those following from this case.

To make the situation clear, it will be necessary to first state, in a brief way, the causes which led up to this particular municipal ownership. Twelve years ago, the town of Santa Clara took up the ownership of water supply. For this there were several powerful reasons; the chief one, perhaps, being the necessity for better protection from fire. This plant was successful from the start. There was also a desire for a more extended system of street lighting; and it seemed advisable to take it up in connection with the water-supply plant. It was installed ten years ago. This also was satisfactory, and people came to have considerable pride in the plants. Every town, like an individual, is pleased to have something to talk about; and the municipal plants came to be the thing to talk about in Santa Clara.

The matter now passed beyond the case of necessity; and the later movements have been largely the result of the impetus of the idea. Municipal ownership became a specialty. Commercial lighting was taken up by buying out the property of the Electric Light Company, remodelling and extending the system, and combining it with the street lighting. Current for the purpose was formerly generated by the town; but for several years it has been bought from the San Jose Light and Power Company, and it is supplied by the standard long-distance transmission lines. Gas was supplied by the San Jose Gas Company (later the Light and Power Company) for years by a pipe-line from their works.

The condition of the town had been such that there had been little encouragement for the Company to extend their lines. There had been no special effort to push the business, and the consumption was only 10,000 cubic feet per day. However, with the coming of renewed life to the town, there began to be felt a desire for more extended service. Chiefly, the development of the gas plant may be considered as due to the idea which had taken root. There was no particular dissatisfaction with the Company, and the movement was entirely devoid of enmity to it. Accordingly all the property of the Company in the town was purchased at a valuation made by an expert agreed upon by both parties. The transaction was amicable and satisfactory throughout.

There has since been considerable increase in the consumption of gas (chiefly for fuel purposes), and the output is at present 35,000 cubic feet per day. The price was at first fixed at $1·75 per 1000 cubic feet; this being the figure then charged by the Company. Afterwards, for service in San Jose, the Company put the rate at $1·50; but no reduction was then made by the town. Still later the Company reduced the rate to $1·25, and the Municipality followed with a reduction to $1·50; and they are now selling at this rate. That is to say, the town has, in the matter of rates, pursued a conservative course, and has made no reduction until virtually forced to do so by the Company. Of course, there is no actual competition between the two; but inasmuch as they serve adjoining territory, it is in practice difficult to maintain a much higher rate in one than in the other.

It will, perhaps, be apparent from the foregoing that an attempt has been made to manage the plant on business principles, and not to be carried away by any popular idea that something could be had for nothing. About 20,000 feet of pipe was taken over from the Company, and since that time about 50,000 feet have been laid. It has been necessary to do this work largely with unskilled labour. At the beginning, the work done in remodelling the distributing system was from necessity advertised. The contractor who undertook the work was not accustomed to laying gas-pipe. The blocks in many cases have very little fall—barely enough for surface drainage. Under these circumstances, the writer put in practice a system of laying to grades previously established by levels; and it has been followed ever since. This is done with so little trouble, and with such good results from

entirely unskilled labour in grading the trenches, that it would seem good policy for any company working in a flat country to follow the same system. In the old pipes, laid in the ordinary way with a spirit-level, there have been frequent traps and stoppages; whereas in the new mains there have not been any. The number of drips is also kept at a minimum, and these are located at convenient points; and where they will do the most good. The particular methods employed had previously been developed for use on sewer work.

Now a few words as to the conclusions from our experience. First of all, the plant and business need continual and watchful care. This is, of course, an entirely unnecessary thing to say to men of experience; but it is a fact that is not fully appreciated by others. In our case, the care has been provided; consequently the business has been successful. It has been very fortunate that there were few changes of officials. The office of President of the Board (or Mayor) has not changed during all this time. The Chairman of the Water and Light Committee also has from the first been identified with the management. Questions of policy have been given as careful consideration by them as though the business had been their own. The result has been a good profit; but it is very easy to see that the balance might have been the other way. This is the chief danger that confronts any scheme of municipal ownership—namely, that men of ability may not be willing to give their attention to the business of the town, or that the people will not have the good sense to keep men of this kind at the head of affairs.

Next as to the ability to meet emergencies. We have recently had an experience of this kind growing out of the partial wrecking of all the plants by the earthquake. This rests upon the men, and not upon the system, and consequently goes back to the first question of management. In our case, we feel no cause for regret, inasmuch as water was supplied in about 24 hours and gas in three days. With regard to the ability to provide extensions, the municipality is decidedly at a disadvantage. Whereas a company can borrow money to meet a large increase in the demands upon it, a municipality cannot do this except by a bond issue, which cannot be resorted to in all cases. Consequently, it is necessary to look well ahead, and provide far in advance for such extensions of magnitude as are likely to be necessary.

As to the attitude of customers. Here we are dealing not only with gas, but with human nature; and this is practically the same the world over. There is an occasional demand for lower rates, in the case of the town, as there would be with a company. There is the same distrust of meters. About half the consumers consider the collector and meter reader their natural enemy. The people's pride in the plant is chiefly in the abstract, and does not particularly affect their attitude toward bills and service. And yet it is not quite fair to leave the question at this; for there is a certain amount of feeling of individual ownership, which probably makes the conduct of these matters a trifle smoother than in ordinary cases.

The conviction of the writer is that a municipality should hardly be advised to undertake the management of plants solely for the sake of profit, as an individual or a company may do. There should generally be other and stronger reasons. In the case of water, there often are such reasons. As we leave water supply and look along the line of other utilities, we find that these causes usually have less force. This does not mean that gas should be supplied at cost. In the first place, in a developing community, extensions and increased facilities in every way will probably be called for. If gas is supplied at cost, all this must either be provided for in the first bond issue (which, on account of its uncertainty, is not practicable), or else by taxation later. Secondly, the question of exact cost is a precarious one at best. It must include all unexpected and emergency expenses, and can really be determined only after a term of years. The probability is that selling gas at cost, as determined from ordinary running expenses, would finally result in the plant requiring support from other funds of the town.

To condense all this, I would say that a municipality, like an individual, should act with judgment and upon competent advice, and not be carried away by impulse in either direction. This is, perhaps, a condition which cannot be fully realized; but in this, as in other affairs of life, it is well to have an ideal.

In the course of the discussion on the paper, Mr. Berkley said the first thing that struck him was that the Municipality of Santa Clara were selling gas for $1·50 per 1000 cubic feet. This, however, did not exactly meet the demands of municipal ownership; but, as the author had rightly said at the close of his paper, they could not afford to sell at a lower figure because of conditions overlooked by ordinary individuals when they were talking about municipal ownership. He knew that in the Middle States, where this ownership had been agitated, the claims were made that people must have gas at cost price. To the ordinary layman, this statement meant something; but it did not mean anything except financial failure. He thought the author was really entitled to a great deal of credit, for while he gave the price, he also stated that gas could not be sold at its cost. They were working at some profit; but, of course, he did not say how much it was. As the Mayor had acted in the same capacity for ten years or more, they could hardly consider this case was a fair test of municipal ownership, because the work had been under the control of the same people so long. Ordinarily municipal authorities were changed, and new men brought into office; but here credit must be given to them for continued service.

Mr. Britton said he had for the past 25 years been a strenuous opponent of municipal ownership, and had written volumes in attempting to show up the fallacies of the reports which were made by municipalities to cover their costs, particularly in the case of electric light plants. If all the municipal owners of plants in California would be as frank, honest, and fair as those at Santa Clara, the public would have nothing to fear. The want of success was due primarily to the lack of management, government, and knowledge. In all municipally-owned plants in California, a man seldom held his position, even as engineer, for a longer term than that of his friends in the Council or Trust, and there was consequently no incentive to work. It had been the habit of all these towns to hide actual expenses—to avoid the question of the cost of operation of one utility by charging interest to another. He did not think that in California they need have any fear of a great stride in municipal ownership, if companies in the State would study their own interests. The policy of gas and electric light men was broadening every day, not only in the reduction of rates, but also in their line of duty to the municipality.

In replying upon the discussion, Mr. Moore said, with regard to the profit made, he had with him copies of the Town Clerk's statement for the present year, and members were perfectly welcome to the information it furnished. The fact that three plants were working together was one element of economy; and another was the officers having been unchanged for the entire period of ten years. There were exceptionally able men at the head of the Board. He had pointed out in his paper that a business was practically the same, whether conducted by a municipality or by a private company; the same difficulties had to be met, and people would not be satisfied. They wanted in all cases to get a good deal for their money. He agreed with Mr. Britton that a reaction was taking place in regard to municipal ownership, particularly in respect of electric lighting plants. In answer to a question as to how he arranged for the renewal and extension of his plant, Mr. Moore said all the money collected was put into the general fund, and this had so far been sufficient to provide for extensions. Nothing was charged for depreciation; but he thought this should be done.

Mr. Lowe (who was in the chair) said he was familiar with the situation at Santa Clara, and could state that the working of the municipal plant there was very much the same as though it was in the hands of private owners. Business men were in charge of it, and they conducted the gas, water, and electric light concerns as if they were their own. They recognized that it was unfair to privately-owned companies to claim results which they had not achieved in practice; and they had published their statements fully and fairly. It was the only instance within his knowledge where a municipality had stated the case exactly as it existed. He added that it was not often that gas men were able to welcome a municipal man to their meetings; and therefore their thanks were due to Mr. Moore for his paper.

The Notification of the Gas Referees for 1907.

The Notification of the Metropolitan Gas Referees for the present year was published yesterday. It differs in only a few respects from the document issued in August last, which was a reprint, embodying alterations (duly notified in our columns at the time), of the thoroughly revised Notification which appeared at the opening of the year. The principal changes in the instructions now under notice consist in the inclusion of certain passages from the London Gas Act, 1905, which will make the Notification more self-explanatory. For instance, in the section dealing with the times and mode of testing for illuminating power (p. 7), a paragraph is inserted specifying that the gas supplied by the Gaslight and Coke Company is required to have an illuminating power of 16 candles, while that of the South Metropolitan and Commercial Companies is only of 14-candle power. In the section in which the Referees prescribe the times and mode of testing for sulphuretted hydrogen (p. 9), they give the provision from section 6 of the Act, setting forth that the gas supplied shall not exhibit any trace of sulphuretted hydrogen when tested in a mode to be from time to time prescribed and certified by them, which mode is not to be more stringent than that prescribed in Schedule A of the Gas-Works Clauses Act, 1871. In Appendix O, the form in which returns are to be made has been altered so as to include the time of making the test.

The Astoria Gas-Works, New York.—In the last number of the "JOURNAL," we reported the starting of a section of the new works which are being erected by the Consolidated Gas Company at Astoria, New York. The retort-house brought into use for the first time on the 3rd ult., by the charging, by the Company's Chief Engineer (Mr. W. H. Bradley), of the first inclined retorts, was put up by Messrs. Bartlett, Hayward, and Co., and contains 64 settings of nines. Another portion of the works—the 15 million cubic feet gasholder, the construction of the tank for which was illustrated in the "JOURNAL" for Jan. 9 last year—is making good progress; and it is expected to be ready by next June. Meanwhile, as already mentioned, the gas made in the new retort-house will be pumped to the Ravenswood works at Long Island City, and sent thence by the East River tunnel to New York.

VARIATIONS IN CONSUMERS' METERS.

By J. M. Rusby, of Philadelphia.

[A Paper read before the American Gas Institute.]

In the following paper is presented some information concerning the causes of erroneous registration and proof of dry gas-meters through decay and "bleaching" or hardening of leather diaphragms and other actions. Though the topics discussed are few in number, it is believed they cover some serious causes of meter registration troubles. The information furnished has been derived from working experience, and also from rather extensive special investigation and experiment by the Company with which the writer is connected;* and it will be presented under various headings.

Diaphragm Decay.

Where diaphragms are of such size, or so mounted, that they continuously or frequently in their motion come in contact with any portion of the metal of the case, injury is almost certain to follow. In our experience, a great number of meters which have become "non-register" or seriously slow, have revealed upon examination diaphragms ruined through this cause. The coating of tin is found to be removed from the sheet iron of the case at the point of contact, and corrosion is in progress. In many cases, the particles of iron compound will be found to have impregnated the leather to very visible extent. The leather is entirely rotten at this point, the particles of iron probably having contributed to this effect. In a great number of cases, the leather remote from these points of contact will be found thoroughly sound, and still capable of years of wear. Furthermore, an examination of the meter-case metal at the point of contact reveals that the product of the corrosion of the iron stands out from the surface in small and sharp projections, which quickly rasp the leather entirely through. The precise cause of this action between the metal and leather we are unable to state. In either purchasing meters or equipping them with new diaphragms, we therefore now have the latter of such size, and so attached, that this contact with the case is entirely avoided. It is already the common custom of makers, I believe, to insert a leather ring between the diaphragm leather and the metal rings to which they are attached. Attention was called to this danger from metal and leather contact by Mr. B. H. Spangenberg in a paper read at the 1904 meeting of the American Gaslight Association.† Meter diaphragms were formerly—indeed, they may to some extent still be—attached to their rings by means of wire winding. It has been our experience that wire for this purpose is inferior to cord. An action probably somewhat similar to the foregoing appears to take place between the wire and the leather, and many cases of breakage of the diaphragm at this point have resulted.

As to the deteriorating effect upon the leather of the various sulphur compounds and other impurities in gas, it seems certain that any one of them will have such effect if existing in considerable percentage. Ammonia is one of the worst. Diaphragm leather dipped into ammonia solution is very quickly reduced to a gluey condition, and on subsequent drying is as brittle as paper. The same general tendency exists with gaseous ammonia. The small quantities of these constituents existing in a properly purified gas have, however, a very slow action indeed, as is shown by the long life of properly mounted diaphragms passing a gas of good quality.

We can find little literature upon this subject. There has been some discussion of it by German gas engineers,‡ and as the result of their experiment and observation, the following statements (among others) are made. Of the gas vapours, xylene is by far the most powerful solvent for diaphragm oils, removing even the refractory oxidized oil compounds used on textile diaphragms. Among the gas vapours are liable to be some which, after deposition in a meter, become rancid, or acidify through chemical change. Also heavy hydrocarbons gradually deposit a non-volatile sticky compound on the diaphragms, valves, &c. These papers and discussions are concerned chiefly with the destruction of the textile diaphragms which were largely in use, and had given much trouble by perforation, breakage, &c. There is some reference to leather diaphragms, however, which are pronounced superior to the textile ones. It seems reasonable to suppose that a leather diaphragm, if kept continually saturated with oil, should deteriorate very slowly indeed from the action of these impurities. Our experiments on the action of ammonia on leather show a marked retardation of injury when the leather is thus thoroughly saturated.

Bleaching or Drying of Diaphragms.

In a paper by Mr. W. H. Gartley at this meeting ["Journal," Nov. 13, 1906, p. 449], are given the facts concerning the condensation of vapours from illuminating gas with falling temperatures, and also diagrams showing the average yearly temperatures of the atmosphere and of the general distributing-mains in Philadelphia. From these curves it will be seen that from the middle of July to about the 1st of March the average atmospheric temperature is below that of the mains; and consequently house meters which are so located as to experience about the atmospheric temperature will generally condense vapours from the gas which they receive from the street, provided it is saturated with vapours at this main temperature. The last condition will exist unless the gas has been subjected to very low temperature at the works before its discharge into the mains, or has passed through some exposed part of the mains. Furthermore, we have taken the trouble to place, and for the period of a full year very frequently read, maximum and minimum recording thermometers immediately adjoining meters in a large number of buildings, so chosen that they represented about average conditions. We find that the average of all these minimum temperatures is higher than that of the mains during the months of December, January, February, and March only, in which months buildings are experiencing their maximum heating; and that, on the other hand, the temperature of the street mains is the lowest. During every one of the remaining months of the year, the average meter appears to experience a more or less frequent fall of temperature below that of the mains—this condition existing to the greatest extent during the autumn. On the other hand, the maximum temperatures are, especially during the winter months, far above those of the mains—producing a superheated or drying condition of the gas at the meter; and in the case of many meters set in warm places, this condition will be long-continued and severe.

During the spring, summer, and autumn months, therefore, there is a general tendency towards the frequent precipitation of vapours in the meters. It is also worthy of note that, because of an affinity between the diaphragm oil and the vapours of the gas, absorption of the latter will occur to considerable extent, even if the temperature of the meter be somewhat above that of the mains. Our experiments have shown this fact; and it has been noted by other observers. These absorbed and condensed vapours are powerful solvents for the oil with which the diaphragms are saturated when placed in the meter. In meters which experience to a marked extent this absorption and condensation, the diaphragm oil is, therefore, quickly thinned by the precipitated vapours and drained out of the leather—leaving the diaphragm saturated with merely the volatile condensed vapours from the gas. If now the temperature of the meter be from any cause raised so that the gas which it is passing becomes superheated, there is a rapid evaporation of these vapours, and the diaphragm is soon left dry or bleached, and somewhat porous, stiff, and shrunken. Its registration is thereby effected; and, moreover, while thus deprived of the protection of its diaphragm oil, the leather is probably subject to injurious action by water vapour and the minute quantities of the various impurities and oxygen in the gas. The oil, once thus removed from the diaphragms and distributed over the bottom of the meter, will not thereafter be again absorbed by the leather, especially if the latter (as should be the case) stands clear of the bottom of the meter. During the remaining period of its service, therefore, the leather will be unprotected by any diaphragm oil. It may again become wet from deposited vapours; but it will immediately dry on a subsequent rise of temperature, and the registration of the meter will therefore vary according to its condition of dryness or dampness.

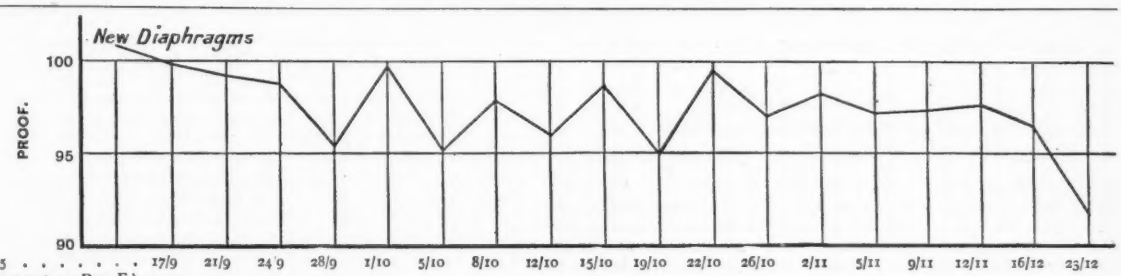
Much annoyance having been experienced from this bleaching of diaphragms, and the foregoing general explanation being arrived at, we have made very considerable special experiments to ascertain the exact facts concerning its effect upon registration, and have also expended much time and money in endeavouring to find a means of maintaining the diaphragm in a constant condition under the continually varying conditions of vapour deposition and drying already mentioned.

Our special experiments upon the bleaching of diaphragms and the consequent effect upon meter registration just alluded to were made as follows: A large number of boxes containing water were prepared, in which the meters could be set. The water in these boxes was artificially cooled, and the gas passing through the meters was thereby brought to any desired temperature. Before admission to the meters, the gas supply was cooled and scrubbed in external vessels to known temperatures relatively to the mains, so that its condition of vapour saturation was actually known. Gas was then passed through the meters in large quantity and for considerable periods—the temperature of the meter being successively lower and higher than that of the gas at its entrance into the meter, with consequent first condensation of vapours therein and the washing off of the diaphragm oils, and a succeeding evaporation of the condensed vapours, producing a drying or bleaching of the diaphragm. The meter was removed, drained, and proved at the conclusion of each low and high temperature period.

The accompanying curve, which represents the average record of one lot of three meters, is generally typical of the provings of such meters. The + and — temperature figures indicate that the meters were proved immediately after passing a quantity of gas this number of degrees above or below the temperature of the gas entering the meters, with consequent condensation of vapour or drying of diaphragm. Thus, under date of Oct. 5, the meters were proved immediately after passing 1583 cubic feet of gas, which in its passage through the meters was 15° above its temperature at the entrance, and consequently there had been a drying effect upon the diaphragms. It will be observed from the diagram that the meters most frequently run fast after drying (the *plus* period) and slow after wetting (the *minus* period) of the diaphragms. This was the general tendency of all meters tested. On raising the temperature of the meters to an excess of 51·7°, they ran over 8 per cent. fast, as shown at the close of the curve.

* The United Gas Improvement Company.

† See "Journal," Vol. XC., p. 885. ‡ *Ibid.*, Vol. LXXXVII., p. 882.



Date, 1905	17/9	21/9	24/9	28/9	1/10	5/10	8/10	12/10	15/10	19/10	22/10	26/10	2/11	5/11	9/11	12/11	16/12	23/12
Meter Temperature (Deg. F.) + or − to Inlet Gas	−5°	+5°	−10°	+10°	−15°	+15°	−5°	+5°	−10°	+0°	−15°	+15°	−5°	+5°	−10°	+10°	+3·4°	+51·7°
Gas Passed, Cubic Feet. . .	1227	1550	1787	1653	1007	1583	1427	1560	1320	1563	1080	1507	1593	1143	863	1240	1010	2803
Total do., Cubic Feet		2777	4564	6217	7224	8807	10,234	11,794	13,114	14,677	15,757	17,264	18,857	20,000	20,863	22,103	22,113	25 916

Diagram showing Variation in Proof of Dry Gas-Meters through High and Low Temperature Effects on "Non-Dipping" Diaphragms.

Even in other meters which were constantly kept at a temperature equal to, or a little above, that of the incoming gas, and in which, therefore, the latter was continually slightly superheated, the absorptive effect of the heavy diaphragm oil upon the vapours was ultimately such as to cause the same bleaching effects. The meters were in great part provided with glass fronts, through which the appearance of the diaphragms could be continually observed; and under the foregoing treatment they all showed bleaching. The passage of 2000 to 3000 cubic feet of gas with a moderately low temperature of the meter was sufficient to produce this effect.

These experiments, therefore, fully reproduce the practical phenomena of the bleaching and drying of diaphragms, and explain their cause. It is evident, as is confirmed by numerous cases in our practice, that meters which have in every-day work been first subjected to temperatures which remove the diaphragm oil, and are subsequently, through house-heating or a rise of atmospheric temperature, subjected to warming and drying, are liable to register seriously fast. Moreover, a meter removed in this condition and proved and adjusted to correct registration with its diaphragms bleached, is liable to be set under such conditions that its diaphragms again become damp from vapours, when it will register slow. Moreover, the leather in this condition, being unprotected by diaphragm oils, is probably much more liable to gradual decay.

Evidently, therefore, to ensure constancy of registration and protection of the diaphragm leather, the latter must either be so prepared that its fibre shall not be acted upon by the gas and water vapours, or the oil or other diaphragm saturating compound must be rendered capable of continually saturating the leather, even while it is being acted upon by these vapours.

Although nearly all our efforts to attain the foregoing result were failures, and, moreover, the method finally adopted for trial is so simple as to warrant very little description, nevertheless a few brief remarks may contain something of interest. Our first efforts were directed towards the finding of a compound which would not be acted upon by the gas vapours, although we were aware at the outset that this would be a difficult matter. A very great number of oils were tried. We scarcely hoped to find one which, in its natural condition, would resist the vapours—the latter being such powerful solvents; but we hoped that we might at least find one which, by special preparation or method of application to the leather, could be made fairly refractory, or would render the fibre of the leather less liable to change of form. With some of these oils we had no success whatever under any conditions. Certain of the vegetable oils—especially boiled linseed, which is the substance chiefly employed in the preparing of the textile diaphragms which have heretofore been used abroad—were rendered somewhat refractory to the vapours when allowed to partially oxidize after their application to the diaphragm, and before the latter is placed in the meter. But even then they would gradually yield to the action of the vapours, or under drying action would harden so as to impede the motion of the meter. Several combinations of these oils were tried, and also various methods of applying them to the diaphragm, including heating in application and careful seasoning. "Soaps" or greases saponified, together with iron and aluminium, were also tried, without any success. Shrinking the diaphragms by immersing them in water, and then drying them before the application of the oil, were then tried. Diaphragms were lightly coated with collodion, which is quite refractory to the vapours, after the application of oil; but the bleaching of the diaphragm through this collodion film quite readily took place. "Flexible compound," which is probably a boiled linseed oil preparation, was tried; but it behaved largely like linseed oil.

Many materials other than the ordinary sheepskin were also tried, among them the following: Both plain and glazed kid, which makes an excellent leather, being firm and non-porous, and changing its shape less than sheepskin. It is rather expensive, however; and, in view of later developments, it seems unnecessary of adoption. "Chrome" tanned and other special tannings of sheepskin; very thin artificial leathers, which became too brittle; various special preparations of sheet rubber; and "*dichtungs-gummi*," a German sheet packing, which has nearly the flexibility and elasticity of pure sheet rubber. The last is remarkably refractory to the ordinary light solvent oils—showing scarcely any tendency to dissolve under their actions; but it absorbed sufficient of the vapours to expand considerably, which rendered it unsuitable for diaphragm use. Then there are silk, linen, and muslin, coated with oxidized linseed oil and flexible compound. These, being thin, would work well, even with a coating of oxidized oil; but this gradually yielded to the vapours, as has been found by foreign users of such diaphragms. Dozens of diaphragms prepared by the methods described were carefully tried in our experimental appliances; but none of them proved at all satisfactory.

Efforts along the foregoing lines having been unsuccessful, other means were sought. It occurred to the experimenter that possibly the capillary action of the leather could be made use of; and investigations were made in this direction. These showed the diaphragm leather to possess unexpectedly high capillarity. It varied with different oils; but it was found that a light machine oil would in three or four days rise 12 or 13 inches in strips of leather, which is the full height of an ordinary 10-light meter diaphragm. It will ultimately rise to a height of 28 to 30 inches, but at a much slower rate. In diaphragms, because of their form, this absorption is less rapid than in these strips. Nevertheless, a new and entirely dry 10-light diaphragm in the meter will become thoroughly saturated from top to bottom through this capillarity in from eight to ten days. It is evident, therefore, that if sufficient oil be placed in the bottom of the meter for the diaphragm to constantly slightly dip into it, the supply of oil upon the diaphragm will be continually quickly replenished, even if temporarily removed in part by condensed gas vapours. This is fully supported by the result of our practical experience with a large number of meters mentioned below; it being very rarely the case that a diaphragm removed from the most trying practical service is not found saturated with oil completely to the top. Moreover, even while the oil is thus temporarily partly removed, the leather will be wet with condensed gas vapours; and this tends to preserve its dimensions and ensure uniform registration.

Experimental meters thus equipped having shown very promising behaviour, about 35,000 meters have been so fitted and put into use during the last fifteen months at Philadelphia. A comparison of the proofs of these "dipping" meters with the proofs of the ordinary non-dripping ones, after the removal of each from service, invariably shows a superiority in the former. Even ordinary meters which had come from the shop within these fifteen months, and the diaphragms of which are therefore in equally good condition with those of dipping meters, show an inferior performance. Fifty of each kind of such comparatively new diaphragm meters recently proved, after nearly a year's work, showed an average net proof of 0·04 per cent. fast in the case of the dipping meters, and 0·8 per cent. fast in the non-dipping. A comparison of the proofs of all meters of each kind proved from Jan. 1 last to date is far more favourable to the dipping meters; the range of fast and slow registration in these being less than half of that existing in the non-dipping meters. In this latter comparison, it is natural that the non-dipping meters should show inferior behaviour to the dipping ones, because the latter had newer diaphragms. Nevertheless, this is the comparison, we believe, which shows most correctly ultimate conditions, as we have good reason to expect that the state of the diaphragms in the dipping meters will for a very long period remain practically the same as when new, whereas the non-dipping diaphragms are certain to experience injury.

While longer trial is necessary to completely establish the excellence of this method in every respect, we seem, from these results, to have every reason to expect a much improved behaviour on the part of the dipping meters. The mere fact that, on inspection, dipping diaphragms are almost invariably found, after service, to be thoroughly saturated with oil, seems to render it positive that serious cases of bleaching will no longer exist, and also that the diaphragm leather will be much less liable to decay and breakage. Consequently, the cases of abnormal slow and fast registration, which are productive of so much loss to the company or dissatisfaction to the consumer, will be avoided, as well as much of the considerable expenditure ordinarily required for meter adjustment and repair.

The dipping oil, even when newly placed in a meter, has no appreciable effect upon the candle power of the gas through absorption of vapours; this having been ascertained by direct experiment with meters subject to even very low temperatures. Being on the bottom of the meter, the oil comes in contact with but little of the gas at a time; and any absorption is exceedingly gradual and small. The oil we are trying is a moderately light,

pure mineral machine oil, from which has been removed all trace of whatever acids have been used in its refining. We have chosen this oil chiefly because it is at ordinary temperatures almost entirely inert and unchangeable chemically, having no tendency to become viscous by slow oxidation, or to slowly form acid or other compounds, which is probably not true of vegetable or animal oils. There seems, therefore, no possibility of its having, even ultimately, any injurious effect on the leather. It is also cheap; the cost of the quantity used in a 5-light meter being only 3 c. or 4 c. It is also absorbed by the diaphragms slightly more readily than any other oil we have tried. In its pure condition, it has a solidifying point of about 35° Fahr., which is a temperature reached by few meters. Moreover, the absorption of even a very small quantity of gas vapours by this oil renders it fluid at 23° Fahr.; and such vapour absorption occurs after the meter has been in use a very short time. Sufficient oil is placed in the meter to immerse about $\frac{3}{8}$ inch of the bottom of the diaphragm; the latter being previously saturated with the same oil. The quantity of oil required for an ordinary 5-light meter is 10 oz. in each compartment, or a total of 20 oz.

It is necessary, as is usual in the ordinary oiling of diaphragms, to let them stand or "season" for a week or ten days, after the application of the oil, before placing in the meter and adjusting the latter. It is better still that the meter be fully equipped with its dipping oil and thus stand before adjustment. This treatment seems, from our experience, to be necessary in order that the leather may experience full saturation and assume final shape.

Effect of Friction and Evaporation of Meter Condensation.

In the course of our work, questions have arisen which have led to the following couple of experiments. The investigations suggested by them we have been as yet unable to make, and the results are quoted simply as general information which may lead to further confirming experiment by others.

Friction of mechanism appears capable of causing very considerable variation in registration; and care in the packing of stuffing-boxes and in the neat fitting of the links, &c., is worthy of attention. The following experiment is quoted: To the crank-rod of a 100-light meter was attached a $3\frac{1}{4}$-inch diameter pulley, upon the perimeter of which was wound a cord acted upon by weights—these being so applied as to successively retard or assist the motion of the meter. A weight of 1 lb. caused the meter to register 8 per cent. slow when retarding the motion of the meter, and nearly 7 per cent. fast when assisting its motion. It is probable that the chief effect of friction is to slightly change the length of stroke where there is any play of mechanism; and even slight change of this kind can quite appreciably affect registration. This friction effect would probably, therefore, differ in every meter. This one experiment is cited simply to show general effects. It appears to indicate, for instance, that a meter which is adjusted with tight or binding mechanism, and subsequently eases up through wear, will run fast. This agrees with our practical experience.

If a meter contains condensed gas vapours, it may still register gas about correctly; the latter being generally saturated with these vapours, and having no tendency to pick up the condensation. In the proving of such a meter with air, however, the air readily absorbs condensation, with consequent increase in volume; and the meter is liable, therefore, even if measuring correctly, to apparently run fast. The action in this case is quite complex. The vapour formed will tend to increase the volume of the air; while the simultaneous lowering of temperature through this evaporation will tend to diminish it. Moreover, these effects will take place gradually while the air is being received and discharged by the diaphragms, and both will be affected by the rate of passage of the air through the meter. To ascertain approximately the net results of these various effects in meter proving, the following experiment was made: A number of meters containing condensation were proved. The air discharged from them was run into another prover and its volume noted; and simultaneously the temperature of the air at the exit from the meter was observed. The meters and all parts of the apparatus were at one temperature at the beginning of the trial. On four successive proofs, passing 8 cubic feet of air on each proof, the average increase in volume of the discharged air as measured in the outlet prover at the constant room temperature varied from 2·9 per cent. on the first test to 1·65 per cent. on the fourth. The temperature of the air was lowered 7° in each proof in passing through the meter. The net result of these opposed effects was to cause the meters to register from 1 to $1\frac{1}{2}$ per cent. fast on the first proof; the error being, however, small after this first, and diminishing to almost zero on the last. It therefore seems that, though the maximum error is not very serious, the passage of a few feet of air through a meter before taking its proof tends towards greater accuracy in showing its actual displacement or registration.

The railway surrounding Vienna, which has been in operation for upwards of ten years, is worked by steam; and it has from time to time caused complaints. The result has been a decision to substitute electricity; and on the 26th of last month a trial trip was made with an electric locomotive. It has been decided by the Government authorities to introduce a change in the system of lighting the carriages, by adopting inverted incandescent burners on the Pintsch system.

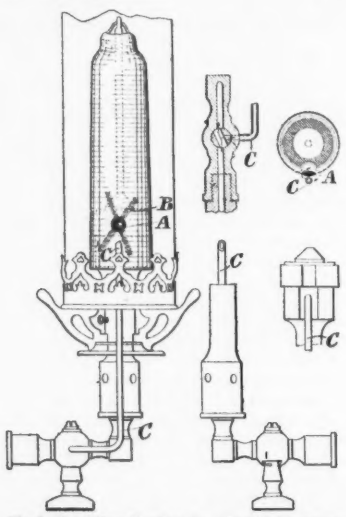
REGISTER OF PATENTS.

Igniting Devices for Incandescent Burners.

Glas, E., of Prossnitz, Austria.

No. 24,223; Nov. 23, 1905.

Instead of placing the igniting pellet (as usual) at the top of the mantle, where it is (when the burner is in use) always in the heat of the flame, and consequently deteriorating, the patentee proposes to attach it to a part of the mantle not intended to be rendered luminous except for the period necessary to light the burner by a current of gas directed towards the pellet by manipulating the tap so as to cut off the gas supply when the burner is lighted.



Glas's Igniting Device for Mantle Burners.

As shown, the igniting medium is a pellet A, with igniting strips or cords B placed on the part of the mantle which is pushed over the burner-head and lies beneath the edge of it. This part is ordinarily never encountered by the gas passing through the burner, nor by the flame or combustion products. To enable the igniting medium to be encountered for awhile by the gas, and thereby made operative, a pipe C connects with the gas-tap, and is bent upwards parallel to the mixing-tube of the burner. When the mantle is put on, the upper end of this pipe lies quite near the igniting pellet. The plug has, in addition to the ordinary bore, a smaller perforation arranged so that it is closed when the tap is entirely open or entirely closed. When, however, the perforation corresponds with the lower end of the main pipe, the pipe which leads to the burner is also opened, but only to a small extent; so that in this position of the tap, gas can escape both to the burner and also to the igniting pellet. When the pellet and strips have become incandescent, and thus ignited the gas flowing to the mantle, the tap is entirely opened. By this latter action, the main gas-pipe is closed and the flame at the upper end of the pipe C is extinguished.

Prepayment or Coin-Actuated Gas-Meters.

Sutherland, A. G., of Birmingham.

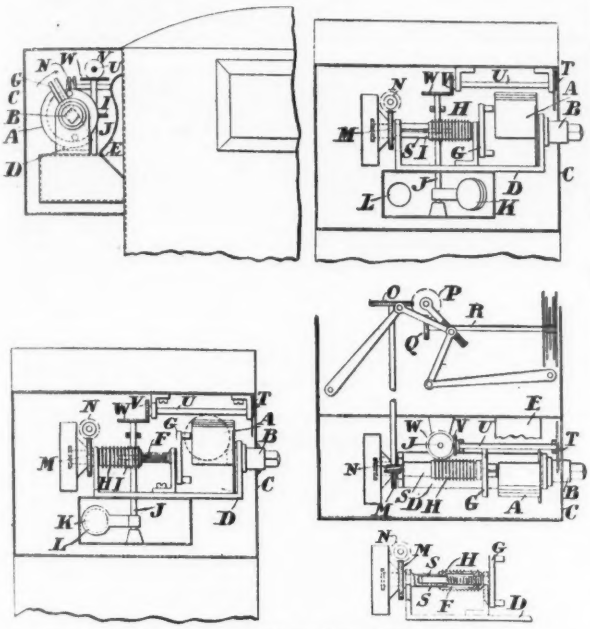
No. 24,382; Nov. 25, 1905.

This invention, relating to prepayment or coin-actuated gas-meters, has for its object to simplify the controlling mechanism and to arrange for the convenient delivery of gas in quantities variable with the amount of prepayment.

In carrying the invention into effect as illustrated on p. 39, there is a slotted or forked coin-carrier A at one end of a rotatable spindle B, which passes through an aperture in the enclosing case C. At the outer extremity of the spindle is an operating handle, whereby the spindle and coin-carrier can be rotated. In conjunction with the coin-carrier is a suitable stop for abutment upon the frame D of the mechanism. After rotating the carrier through half-a-revolution, further movement is prevented by contact of the carrier with the frame D. When in its initial position, the coin-carrier is in alignment with a coin insertion aperture in the case of the mechanism. By revolving the carrier, it is brought into alignment with a discharge aperture through which the coin automatically falls into a coin receptacle (not shown). During the rotation of the carrier, the coin is prevented from dislodgment by a curved abutment piece E arranged between the inlet and the outlet apertures.

In alignment with the carrier spindle B is an ordinary operating screw F, for the meter valve controlling mechanism, and at the end of the operating screw adjacent to the coin-carrier a clutch disc G or bar is provided; a pair of projections at opposite extremities of a diameter of the disc engages with a coin placed in the carrier, as shown by dotted lines. The screw also engages with a cylindrical nut H, around which circumferential grooves are cut, so that it can be made to serve as a rack for gearing with a pinion I secured to a delivery valve operating spindle J.

The delivery valve consists of a disc K adapted to close an aperture L in the side of the meter, and is supported by a radial arm secured to the valve-spindle J. On rotating the spindle, the valve K is withdrawn from, or advanced towards, its seating in the usual well-known manner. On the insertion of a coin in the carrier and its rotation by the handle,



Sutherland's Prepayment or Coin-Actuated Gas-Meter.

the operating screw F is actuated by the engagement of the coin with one of the projections on the clutch disc G. A lateral movement along the screw is in consequence imparted to the rack H, which results in the opening of the valve K, through the medium of the pinion I and valve-spindle J.

For the automatic closing of the valve K, the rack H is adapted to be rotated upon the screw spindle F by a worm wheel M engaged by a worm N, which is operated from any convenient portion of the meter mechanism—such as through the medium of a worm wheel O gearing with a worm P, with which also engages the worm wheel Q on the main spindle R of the consumption recorder. The worm P is automatically rotated by the ordinary measuring movements of the meter in the usual manner. During the passage of gas through the meter, and the consequent rotation of the worm P, the rack H is rotated; and, due to its nut-like engagement with the screw spindle F, it is moved along the latter towards its original position. This movement results in the actuation of the valve-spindle and in the gradual closing of the delivery valve upon its seating. To permit the necessary relative lateral movement of the rack H with respect to the wheel M, the rack is feather-keyed to a bush-like extension S, which fits over the end of the screw F and is connected to the wheel M.

When it is desired to obtain a greater quantity of gas than that corresponding to the value of the single coin (such as a penny) by which the meter can be operated, a number of such coins are successively inserted, and the handle rotated after each insertion. A proportionately increased movement is thereby imparted to the delivery valve. Thus the meter can with but one prepayment of two or more coins be readily adjusted to deliver corresponding quantities of gas within a convenient range determined by the limit of the lateral movement capable of being imparted to the rack H on the operating screw F.

For indicating the number of coins inserted at each prepayment, any ordinary indicator with index finger T may be provided on the meter case. Thus, the index finger can be secured upon a spindle U adapted to be rotated by a wheel V gearing with a wheel W on the spindle J. With each insertion of a coin, and consequent operative movement of the delivery valve, the index finger is moved to correspond therewith; while during the gradual closing of the valve, as the gas is delivered therethrough, the finger is simultaneously returned to its initial position. The indicator also serves during the working of the meter to record—in terms of the value of the operating coin—the amount of gas that will be delivered before the valve K is completely closed and another payment is required.

To provide for varying the quantity of gas obtainable by the insertion in the meter of a coin or coins as described, the worm wheel M is arranged in detachable connection with the bush S, so that it can be readily replaced when required by one of smaller or larger diameter.

Lamps for Inverted Burners.

FRANCIS, A. S., of Farringdon Road, E.C.

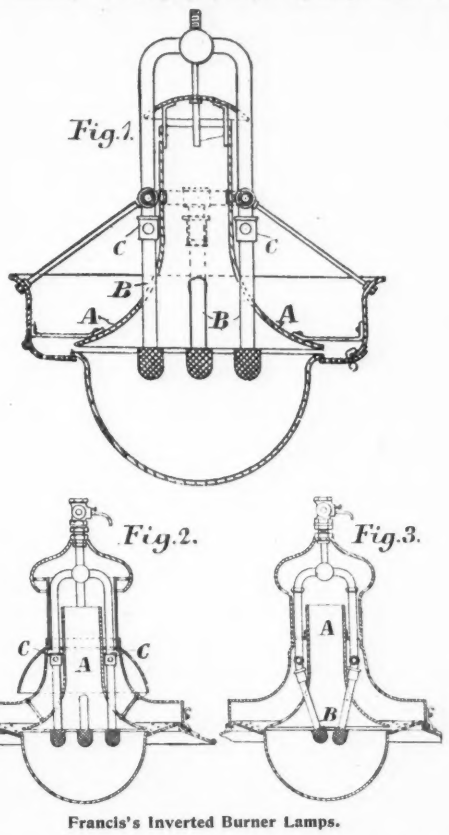
No. 24,410; Nov. 25, 1905.

This invention—relating as it does to lamps for containing incandescent gas-burners of the type in which a cluster of two or more inverted burners is employed in a globe or lantern—has for its object "to increase the efficiency of the burners in such lamps, and to render them readily accessible for cleaning, adjustment, and repair."

Fig. 1 is a sectional elevation of an indoor lamp, and figs. 2 and 3 are similar views of two constructions of outdoor lamps.

Fig. 1 shows the lamp provided with a trumpet-shaped chimney A (more or less like the frustrum of a cone), the wider part of which is below. The burners B are preferably merely straight metal bunsen tubes provided with gas-nipples and with mixing-chambers C at the top and suitable mouthpieces and mantle supports at the bottom, but without deflector or other like contrivances. They pass vertically through holes in the side of the chimney near the lower end; so that the points of the burners are within the cone of the chimney, while their mixing-chambers or heads, with the air inlets, are outside of the chimney. Thus the products of combustion flow straight up within the chimney, away from the air-inlets. The globe is preferably, but not necessarily, entirely closed at the bottom, and is suspended from an annular hinged plate provided with a number of holes to admit air to the interior of the globe, so as to support combustion, and, if desired, to the upper part of the lamp for the supply of additional air to the mixing-chamber.

If the lamp be intended for use out of doors, the upper part is made as shown in fig. 2—encased and provided with a domed top to prevent the ingress of rain and wind; the products of combustion rising up the cone-shaped chimney and escaping by way of openings below the top



Francis's Inverted Burner Lamps.

or cowl of the lamp, as usual with street-lamps. The lower part of the chimney A is enclosed by an outer chimney, so as to leave sufficient space for the air to pass to the mixing-chambers of the burners. This outer chimney may also be provided with holes for the admission of air to supply the burners, and the holes may be shielded from rain and direct draughts by an annular cap or covering. The outer chimney, its extension, and the top, may be in one piece or separate; while the extension and the outer chimney are in one piece. Air is admitted through the perforations in the annular plate supporting the globe.

As shown in fig. 3, the burners are not quite vertical; being slightly inclined towards each other. The outer chimney may here be fitted to the inner chimney by the flanged part, and the top of the lamp be made in one piece with the annular extension.

Mantles for Incandescence Gas Lighting.

LAKE, H. H.; a communication from the DEUTSCHE GASGLÜHLICHT AKTIENGESELLSCHAFT (Auergesellschaft), of Berlin.

No. 24,949; Dec. 1, 1905.

In accordance with the present invention, the place of attachment of the inverted mantle to the supporting ring is reinforced by the application of a mass consisting either wholly or in part of fireproof material, applied either before or after the treatment with collodion. The defect that it is desired to eliminate is mainly attributable to the fact that at the place at which the fabric comes into contact with the supporting ring it is not sufficiently incinerated when the burning off is effected, because the supporting ring conducts away too quickly the heat of the burning-off flame. If, however—even after burning off—there is applied to the incinerated or skeleton fabric, where it comes into contact with the supporting ring, a hardening and heat-resisting mass consisting of inorganic substances, or of inorganic substances mixed or combined with organic binding materials of any appropriate kind, the defect arising from the reduction of the strength of the incandescing body at the place of connection by the burning off is compensated for.

Globes for Inverted Incandescent Burners.

HELPS, G., of Nuneaton.

No. 26,407; Dec. 18, 1905.

This invention consists in providing means whereby the air entering the bottom of the globe of an incandescent burner and passing to the outside of the mantle is caused to enter by a number of small streams, so that the mantle is protected from damage by draught.

For this purpose, a ball may be used of glass or metal, so arranged

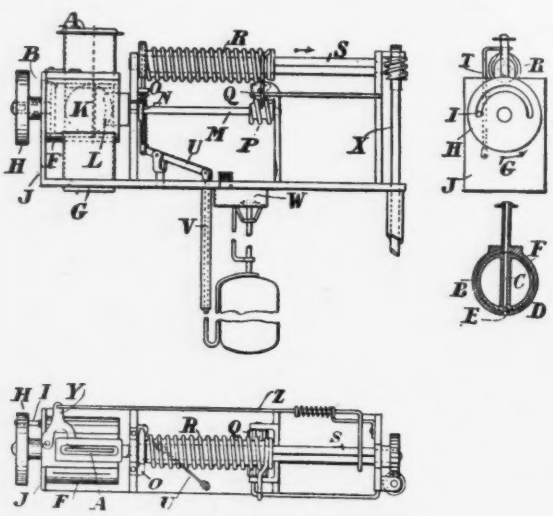
that, when on its seat in the globe, it allows just sufficient air to pass for proper combustion, and it also allows of a torch being inserted through the hole to light the lamp without difficulty—the ball, when the torch is withdrawn, rolling back on to its seat. Such solid balls, the patentee remarks, have been used in lamps in lieu of lighting-doors; but they have not been employed as screens as described. The ball may take many forms. The seat for the ball may be continuous, and the ball fluted on its circumference, so that, when it is on its seat, sufficient air passes into the globe for combustion; or the ball may be hollow, having holes all over its surface.

Coin Slot-Meters.

KING, M., of Wickham, and JAMES, J. E., of Islington, both in New South Wales.

No. 24,533; Nov. 27, 1905.

This coin-actuating mechanism (here illustrated in connection with a wet gas-meter) comprises a carriage having a coin pocket, means to give the carriage a half-turn and drop the coin therefrom, means whereby the half-turn causes a worm to slide a predetermined distance, means whereby the worm is automatically returned through the action of the meter, the provision of a cam upon the worm shaft, an arm released when the worm slides, connections from the arm to a valve allowing it to open when the arm is released, and a tube forming a water seal.



King and James's Coin Slot-Meters.

In the illustration, the mechanism is shown apart from a meter, and without the casing, cash-box, and indicator (or dial) used—viz.: (1) A side elevation of parts when all gas paid for has been supplied, the mechanism being locked, but ready to be operated on the insertion of a coin; (2) a plan view; (3) a left-end elevation; and (4) a vertical transverse section.

A is a coin shoot or passage; B a cylindrical carriage having a coin pocket C, and base D on which the coin may rest; and E an aperture in the carriage casing F to discharge the coin when the carriage is given a half-turn—the coin then dropping, as through passage G, into a cash-box. H shows a handle adapted to turn the carriage, and I a stop on the framing J—to limit the travel of the handle and carriage so that, before the half-turn is made, the coin can enter the carriage and take the position K. L indicates a slot in a lug on a shaft M, having suitable means to prevent the turning of it backwards. A ratchet wheel N, having at least two opposite notches or teeth, with a spring pawl or pressure stop O, is used. The lug is turned a half-circle each time a coin is dropped from the carriage.

Mounted on the shaft M is a worm P geared to turn a pinion Q, which engages with a worm R slidably mounted on a shaft S. The pinion turns and the worm slides a predetermined distance—for example, one thread turn—when the handle H is turned and a coin is admitted to, and dropped from, the carriage B.

Mounted on the worm R is a cam, which, before the insertion of the coin, holds up one end of the arm T attached to the lever U, which has an arm V so mounted relatively to the float valve that its motion governs that valve. While another cam holds up the arm T, an eye or stop on the arm V keeps the valve float down; and so the valve is closed so that gas cannot enter the meter. But when the worm R slides forward, the arm T drops—being assisted or forced down by a spring or the like. This operates the lever U and arm V, raising the stop so that the float rises, whereupon the valve W opens and admits gas to the meter. When enough gas has been consumed, mechanism (hereafter explained) causes the eye or stop to descend and close the valve. A toothed wheel on the shaft S gears with the worm on the meter spindle X by which the usual meter index train is operated.

As gas is consumed, the spindle X turns the shaft S; and the pinion Q being kept stationary, the worm R not only turns, but also slides back towards the arm T. The pawl pressure on the ratchet N is made sufficient to resist any tendency of the pinion Q to turn. At the end of the worm R is a recess or support for a loose ring which does not turn with the worm, and which carries a pointer to indicate the number of coins inserted in respect of which gas is still consumable. If, for example, three coins were inserted and the worm R thus carried a distance of three threads in the direction of the arrow, the pointer would indicate 3; then when the consumption of gas began, it would indicate in due time 2, then 1, and finally 0. The worm R will have returned to its starting point when all the gas paid for has been consumed; and the cam will then have passed under the end of the arm T and raised it so as to close the valve W.

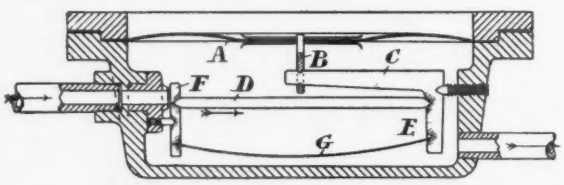
The tooth wheel is changeable—allowing one with more or less teeth to be substituted according to the price of gas. Z represents a rod so located that, when the coin effecting the maximum prepayment—for example, the twelfth penny—has been inserted, the worm R will press the end of the rod Z and cause the other end of the rod, which is connected to a cut-off plate Y, to swing the plate so that a lug on it enters an aperture in the coin-shoot side and prevents any additional coin descending beyond the lug.

Gas-Pressure Regulating Devices.

HOWARTH, F. W.; a communication from AKTIEBOLAGET GAS-ACCUMULATOR, of Stockholm.

No. 6425; March 16, 1906.

This gas-pressure regulating device is designed to maintain a certain constant pressure in a gas-conduit notwithstanding variations of pressure in the conduit prior to reaching the apparatus.



A Swedish Gas-Pressure Regulating Device.

One wall of the casing shown comprises a diaphragm A connected through a link B with a lever C mounted to turn on fulcrum points fixed to the casing. A bar D is inserted between the lever (or a projection E depending from same) and a plate F, against each of which it bears at its ends, which are pointed. The plate serves as a valve, and is mounted to rock on points fixed to the casing or to a separate piece secured to the casing. Between the lower part of the valve plate F and the lower part of the lever projection E is inserted a blade spring G, the strength of which is adjusted in such a way that the spring counterbalances the gas pressure on a diaphragm when the pressure corresponds to that required in the outlet conduit. Variations of pressure will cause the diaphragm to ascend or descend, so that the blade spring is expanded or depressed, and the valve plate correspondingly moved towards, or removed from, the valve seat by means of the bar D; the flow of gas through the valve being accordingly diminished or increased until the valve plate, owing to the diminished or decreased pressure in the casing, returns to its original position controlled by the diaphragm and spring.

Electrical Ignition of Gas-Lamps.

ELECTRICAL IMPROVEMENTS LIMITED and A. E. HACKING, of Nottingham.

No. 6441; March 17, 1906.

The manner proposed for electrically lighting up gas-lamps consists in providing for the burner of each lamp a complete compound switch, preferably arranged to have three functions—namely, to simultaneously close a low-tension circuit, a sparking circuit, and turn on the gas, applying the switch, as the most convenient arrangement, to the gas-pipe feeding the burners. There are battery terminals and spark-coil terminals forming part of the switch to be simultaneously closed. One battery and one sparking coil are used, and branch wires for each lamp are taken from main wires from the battery and coil in such a manner that each individual switch controls both the battery and the coil. In this way the operation of a single element at the burner closes the battery circuit and the sparking circuit, and turns on the gas—there being, however, a compound switch for every lamp, with a switch capable of independent operation.

Photometrical Apparatus.

WILD, L. W., of York Street, Westminster,

No. 7543; March 29, 1906.

After explaining in general terms the use of waxed discs in photometers, the patentee proceeds in his specification to say: If a disc, as described, is viewed through a diaphragm, so that the eye sees a portion of the disc only, and the disc is then rotated on its centre in such a manner as to present to the eye alternately and in quick succession first an opaque reflecting area and then a translucent diffusing area, a distinct flicker will be seen so long as the two portions of the disc are not equally illuminated. The flicker occurs each time the dividing line between the two portions of the disc crosses the field of view. By adjustment of the distances between the disc and the lights, the flicker can always be made to entirely disappear—provided that the lights are of the same colour. This occurs when both portions of the disc are equally illuminated. Should the lights differ as to colour, the flicker can still be made to disappear on adjusting the distances between the disc and the lights—provided always that the speed of rotation attains a greater value than a certain critical speed. It would appear as if the speed at which the flicker due to difference of colour disappears is considerably lower than the speed at which the flicker due to difference of intensity disappears.

The advantages of using a rotating disc, as described, over other forms of flicker photometer are said to be two—namely, the two sides of the disc being always parallel, any tilting due to side-play between the carriage on which the screen is mounted and the bar or rails on which it runs involves no appreciable error, as the two sides of the screen are affected about equally; and, also, should either of the lights

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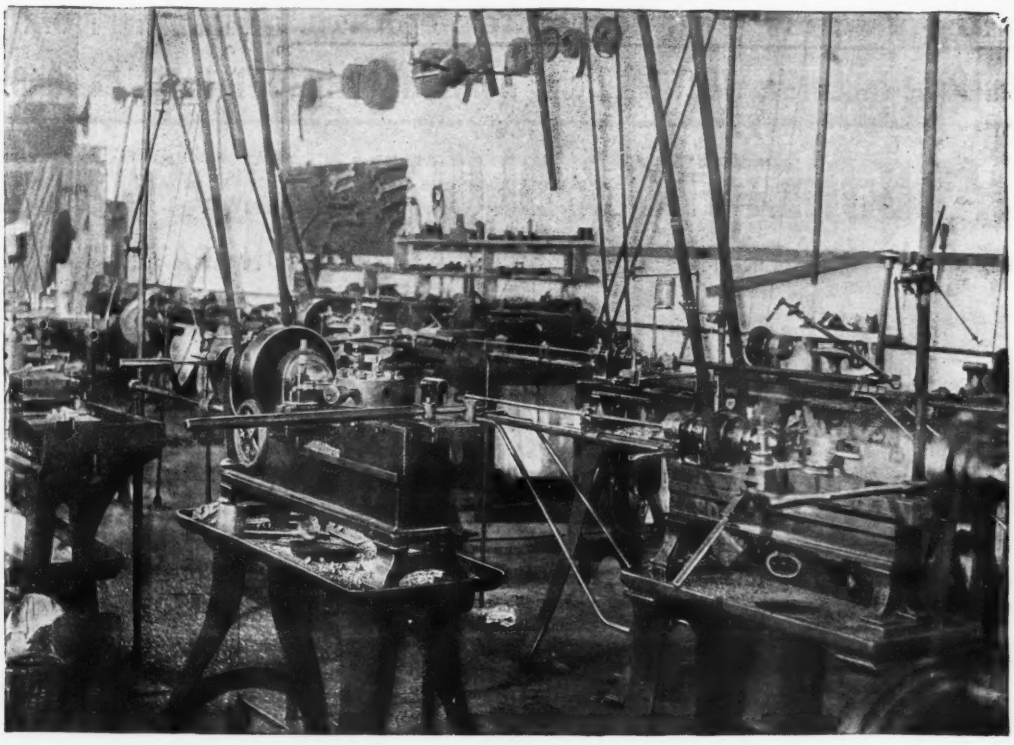

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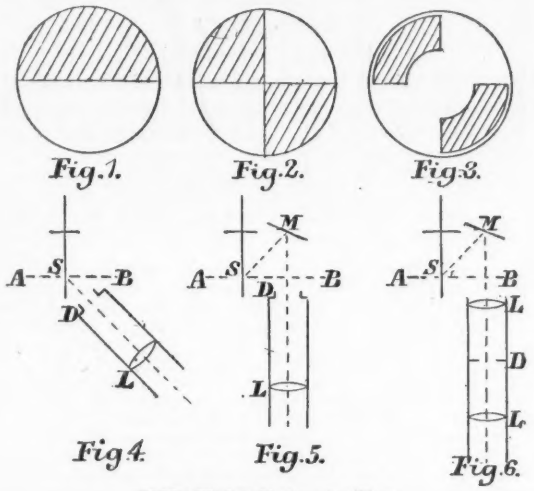
AND 45 & 47, WESTMINSTER BRIDGE ROAD, LONDON, S.E.

Telegrams: "METRIQUE, LONDON." Telephone No. 2412 HOP.

be out of alignment by a small angle, the illumination on the screen is inappreciably affected; whereas in photometers consisting of two reflecting surfaces inclined in opposite directions, the error due to tilting may amount to as much as 4 £ for each degree of angular side-play and 2 £ for each degree of angular displacement of one light only.



Wild's Flicker Photometer Discs.

Figs. 1 and 2 show two forms of disc, consisting of white absorbent paper, the shaded portion of which has been made translucent and diffusing by the application of paraffin wax or other suitable material. Fig. 1 shows a disc which gives rise to two flickers per revolution, and fig. 2 a disc which gives four flickers per revolution, which allows of the speed of rotation being reduced if desired. Fig. 3 shows a built-up disc; the shaded portion being translucent. Figs. 4, 5, and 6 show three methods of viewing the disc.

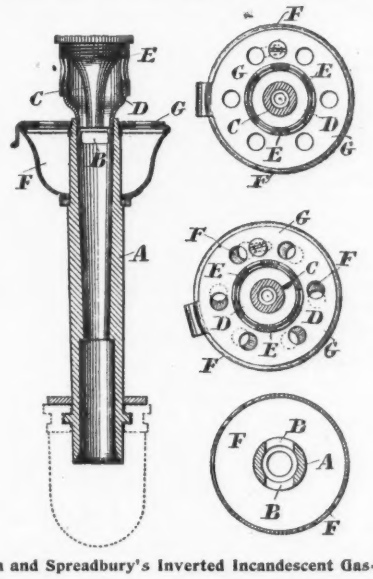
In fig. 4, the lights A and B shine upon opposite sides of the disc S, which is viewed at an angle of about 45°, through the diaphragm D and lens L. In fig. 5, the mirror M has been added, so as to bring the observer's eye into a more convenient position. The chief objection to this method of viewing the disc is that the disc, when revolving, shows no detail, and is not easily focussed by the eye; and if a diaphragm is added, the eye focusses upon this, and the disc being far off is out of focus. In fig. 6, a telescope has been substituted for the simple lens and diaphragm. The lenses L are so arranged that when the eye is focussed upon the diaphragm D the disc S is also in focus—"thus securing the maximum degree of sensitiveness and the minimum fatigue to the eye."

Inverted Incandescent Gas-Burners.

SINGLETON, J. E. E., of Wolverhampton, and SPREADBURY, E. L., of Northampton.

No. 6761; March 21, 1906.

In the burner-tube A are formed additional or secondary apertures B, so as to admit of a supply of air to the burner-tube at a point immediately below the axial gas-nipple C, which is made somewhat longer than is usual. The upper part D of the burner is of the ordinary construction, and is fitted with the perforated ring or sleeve E, by the



Singleton and Spreadbury's Inverted Incandescent Gas-Burner.

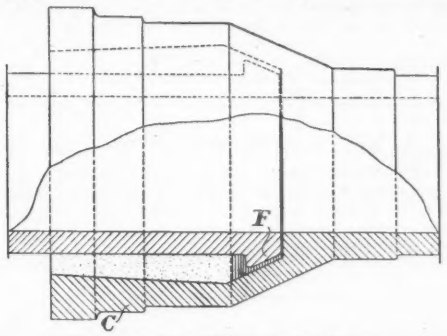
turning of which the ordinary air-admission holes of the inverted burner are regulated. The air holes B open into an annular chamber F, the flat top of which is perforated and provided with an adjustable perforated ring G, by the partial rotation of which the holes can be more or less contracted or wholly closed. By the secondary air supply to the burner-tube at a point immediately below the gas-nipple C (which is made somewhat longer than usual), a more efficient admixture of gas and air is said to result than with the ordinary inverted burner, or with inverted burners having a secondary air supply as hitherto. The improved burner-tube is made to gradually taper internally from its upper to near its lower end, so that the speed of the mixture of gas and air passing down it may be caused to gradually increase. In conjunction with the secondary air supply immediately below the nipple of the burner, the tendency to back-firing is claimed to be wholly or in great part overcome—the flashing-back point being removed to a point coincident, or approximately coincident, with the part of the tube of smallest internal diameter.

Joint for Water and Gas Mains.

FORD, G. T., of Tottenham Court Road, W.C.

No. 15,379; July 6, 1906.

This arrangement has been designed with the object of preventing any slipping of the joints owing to excessive pressure on the mains.



Ford's Joint for Water and Gas Mains.

The spigot and socket would be cast as at present, with the following variations. The spigot would be finished with a splayed projecting bead F, and the socket C cast to correspond with the end of the spigot; the socket being much shorter than the standard size. The splayed projecting bead and the socket are formed so as to fit so closely together as to become practically air tight, even before the lead is used for jointing.

The joint has, it is said, been designed with a view to a great saving of lead in the laying of mains. For example, a standard pipe, 1 foot in diameter, would take 19 to 20 lbs. of lead to make the joint; while this joint, with its splayed projecting bead and shorter socket, would, it is claimed, only require 14 to 15 lbs.

APPLICATIONS FOR LETTERS PATENT.

28,689.—SOCIÉTÉ ANON. DES COMBUSTIBLES INDUSTFIELLES, "Distillation of hydrocarbons." Dec. 15.

28,752.—SWEET, A., "Gas cooking-ovens." Dec. 7.

28,761.—WILLIAM CROSS AND SON, LTD., and CROSS, J. W., "Gas cookers or grillers." Dec. 17.

28,783.—HAMAKER, J. I., "Combined heating and cooking stoves." Dec. 17.

28,796.—ABEL, K., and PERVESLER, F., "Lighting gas at a distance." Dec. 17.

28,834.—CROSSLEY, W. J., and RIGBY, T., "Producer gas-generators." Dec. 18.

28,881.—HOLLICK, T. D., "Automatic grabs." Dec. 18.

28,891.—SPANGENBERG, F. A., "Opening and automatically closing gas delivery-pipes." Dec. 18.

28,898.—M'MAHON, P. V., "Liquid meters." Dec. 18.

28,949.—WEBB, H. R, "Lighting inverted burners." Dec. 19.

28,963-4.—WOLTERECK, H. C., "Production of ammonia." Dec. 19.

28,990.—KENT, W. G., "Liquid-meters." Dec. 19.

29,000.—LAKE, H. H., "Gas-burners." A communication from J. H. Ackroyd. Dec. 19.

29,025.—DAVIS, H. N., "Gas cooking-stoves." Dec. 20.

29,026.—PRICE, H. A., and TURNER, H. C., "Gas-fires." Dec. 20.

29,038.—THORP, T., "Water-meters," &c. Dec. 20.

29,040.—LEA, J. W., and PERRINS, J. H., "Dust-traps and gas-regulators." Dec. 20.

29,078.—ROGERS, W. J., and WOOSNAM, W. W., "Effecting the discharge of measured quantities of fluids into tanks or reservoirs intermittently filled and emptied." Dec. 20.

29,115.—BOULT, A. J., "Combustion of gaseous fuel." A communication from E. Bohon. Dec. 20.

29,123.—NEHMER, H., "Electrical apparatus for lighting gas." Dec. 21.

29,132.—THORP, T., "Rotary blowers." Dec. 21.

29,155.—NORDEN, J., "Mantles." A communication from C. Bartel. Dec. 21.

29,163.—CONSTABLE, S., "Self-propelled vehicles for spraying tar on roads." Dec. 21.

29,173.—FALK, S., "Mantle-supports." Dec. 21.

29,201.—ALLGEMEINE ELEKTRICITÄTS GES., "Meters for gas and the like." Dec. 21.

29,205.—GAS-METER COMPANY, LTD., and GOW, J., "Coin-freed gas-meters." Dec. 21.

29,223.—GROSSMANN, J., "Treatment of ammonia liquors before and after distillation." Dec. 22.

29,231.—HURLEBUSCH, H., "Portable gas-producer, purifying apparatus, and gas-engine." Dec. 22.

29,252.—EHMANN, C. P., "Bunsen tubes." Dec. 22.

29,284.—SPREADBURY, R. J., "Inverted lamps." Dec. 22.

29,291.—DUNCAN, G., and HARDIE, W., "Manufacture and purification of illuminating gas." Dec. 22.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by our Correspondents.*]

Electrolysis as a Cause of Fire.

SIR,—Referring to the editorial remarks on the "Relative Dangers of Gas and Electricity" in the "JOURNAL" for Dec. 18, I may say we have had an experience which is probably somewhat unique, and at the same time highly instructive. A fire arose at a laundry where gas was found burning from a 1½-inch lead outlet-pipe near the meter. Luckily the fire was speedily put out, before the evidence of the originating cause of the ignited gas-pipe was obliterated. This pipe showed that it had been pierced and lighted by an electric spark about ½ inch in length, which had passed from an adjacent steam-pipe. The problem arose as to how the spark had been caused. The steam-pipe was nowhere near an electric wire. But immediately before the fire arose an electric motor had gone wrong, and a fuse burnt out. The electricians could not gainsay the evidence of the facts that electrolysis had taken place between the two pipes; but they could offer no explanation of the phenomenon. It occurred to me that the breaking of the primary circuit had induced a momentary secondary current in the steam-pipe, which was well-insulated, causing a high-potential spark to pass to the gas-pipe. This theory was accepted by the electrical engineer as being the only satisfactory one under the circumstances.

We have had two or three instances of gas-pipes being pierced and ignited through the breaking of motor circuits; but in these cases it appeared to be due to the earthing of the current. The induction theory may explain other fires caused by the gas escaping and burning where no evidence remains.

York Gas-Works, Dec. 22, 1906. J. H. HILL, Assistant-Manager.

Recent Railway Accidents and the Safety of Gas Lighting.

SIR,—I was very pleased to read the article on the above subject in your last issue, as it is quite in accord with my own experience of years ago; and I notice that your contemporary, the "Engineer," in its issue of the 21st inst., takes a similar view. I believe that Lieut.-Col. von Donop is imaginative in attributing any undue danger to the use of gas for the lighting of railway carriages.

Having been associated with the running of the first gas-lighted coaches on the main line of the Great Western Railway, I know the question of possible danger was fully considered. Experiments were made with the gas-cylinders secured on the under-frame of a carriage with the connecting pipes, to show the effect of violent impact, which was communicated by fly-shunting to represent the effects of collision and derailment. It was always found that the cylinders were unaffected, and whatever fractures took place were in the connecting-pipes, where the gas escaped so slowly into the open air that there was little possibility of danger.

I have also had several opportunities of examining the gas-fittings of coaches after actual collisions. One instance I remember in particular, on the District Railway at the Gloucester Road Junction. In this case, the lights were extinguished by the collision, and some of the small pipes fractured, so that the gas escaped gradually out of the cylinders without doing any harm.

Of course, the great point to be considered by railway companies above everything else is the question of public safety. I agree with you that electricity does not give immunity in this respect; and, although I have watched the progress of train lighting by electricity since Mr. Stroudley first introduced it into the Pullman cars on the Brighton Railway, I cannot consider that—in respect to the cost of fitting up the coaches, the cost of running, the efficiency of the lighting, or safety—it can commend itself as altogether satisfactory to the railway companies themselves, except in the case of tube railways. I came to this conclusion years ago, after prolonged investigation at home and abroad of the various ways adopted for lighting railway stock; and although my work has for some years now been in an altogether different direction, yet I have never lost interest in the subject, which always had a fascination for me, as it opened up possibilities which are gradually being realized.

In America, it is interesting to note, bracket gas-lights are in use in observation cars over the writing tables.

In the "JOURNAL" during the eighties will be found a record of experimental work done in this respect by myself and in conjunction with the late Mr. F. W. Hartley and Mr. Frank Clark; and when a few years back I saw the adoption of the incandescent mantle for carriage lighting carried out on the French and Swiss Railways, I could not help feeling what a chance the railway engineer now had in securing efficiency and economy in lighting, combined with effective ventilation, which is not the least important advantage of gas lighting, even in a railway carriage, with the windows closely shut and the influenza microbe paramount.

Hastings, Dec. 27, 1906. CHAS. E. BOTLEY.

Leek to Supply Rudyard with Gas.—The Leek Urban District Council have agreed to a recommendation of the Gas Committee that a scheme for supplying Rudyard and Longsdon with gas should be carried out, and that application should be made to the Local Government Board for a loan of £1800 for the work. The North Staffordshire Railway Company have granted permission for the necessary main to be laid along their track, subject to the payment of a yearly acknowledgment of £1, and a discount of 10 per cent. from the price of all gas supplied to the Company's premises—the Council to be liable for any accident which may happen, and which could not have happened but for the pipes being so laid along the line. The arrangement is to be for 21 years; and the Council will then have the option of renewing the lease on the same terms.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Monday, Nov. 26.

(*Before Mr. Justice* JELF.)

Chester Water-Works Company v. Guardians of Chester Union.

In this case the question for the decision of the Court was whether the Guardians of Chester Union were entitled to a supply of water for their workhouse at the rate charged for domestic purposes.

Mr. BALFOUR BROWNE, K.C., Mr. RANDOLPH, and Mr. M. GWYER (instructed by Messrs. Busk, Mellor, and Co.) appeared for the plaintiffs; Mr. DANCKWERTS, K.C., Mr. MONTAGU LUSH, K.C., and Mr. ELLIS GRIFFITHS (instructed by Messrs. Chester and Co.) represented the defendants.

Mr. BALFOUR BROWNE, in opening the case, said that in 1876 the defendants applied to the Water Company for an estimate of the cost of carrying a 6-inch main to the workhouse. The Company gave an estimate and agreed to bear an expense of £200, on condition that they were paid for the water supplied a minimum sum of £20 per annum for three years—the charge being dependent entirely on the quantity of water taken. The pipes were duly laid and a meter was put up; and on Feb. 14, 1877, the Guardians accepted the Company's offer, and were supplied by meter from that time at the rate of 8¼d. per 1000 gallons. This arrangement continued till 1899, when the Guardians applied for a reduction in the charge; and in January, 1900, the Company agreed to allow a discount of 10 per cent. when the consumption exceeded a million gallons per quarter. This went on for some time; but in 1901 a discussion took place at a meeting of the Guardians, and a resolution was passed requesting the Company to remove the meter, and demanding that they should supply all the water required as for "domestic purposes," under section 43 of their Act of 1857, by which the Company was incorporated. In December, 1901, the Guardians discontinued the use of a certain wood-chopping machine in the workhouse; but they paid for the water used in the September and December quarters. In January, 1902, the Guardians tendered the sum of £12 1s. 3d., which they said was the quarter's rate in advance, calculated on the annual value of the premises supplied, which was about £960. This, however, was not a good tender, because they tendered only on the annual value, and did not add anything for the extra water-closets, baths, &c., for which the Company had a right to charge even if they were obliged to give a domestic supply on the annual value. The Company offered to refer the question to arbitration; but the defendants would not agree to this. After some negotiations, on July 6, 1904, the plaintiffs issued the writ in the action. The Company had two Private Acts—one obtained in 1857 and a subsequent one in 1874. Under their 1857 Act, section 43 dealt with the amount to be charged for water for domestic purposes; section 44, beyond the rates authorized to be taken under the previous section, provided that the Company might demand certain payments in respect of additional water-closets beyond the first, and also for baths, and so on. Section 46 defined "domestic" purposes, which excluded a supply for baths, steam-engines, working machines or apparatus, or for any trade, manufacture, or business whatever. There had been two or three cases on somewhat similar points, in one of which Mr. (now Lord) Justice Buckley gave an elaborate judgment. But in the present case the Company had a special provision in their Acts which, to some extent, distinguished this case from any other previously decided. By section 47 of their Act of 1857, they were required to supply any person with water for other than domestic purposes at such rate as might be mutually agreed upon, or, failing agreement, on such terms as might be determined by any two Justices, provided that the supply for domestic purposes was not in any way interfered with or endangered. This section had never been put into force. The Company said the supply demanded in this case was for other than domestic purposes; and they always claimed that it should be furnished by meter. The issue raised was: Was this a case for domestic supply or a supply by meter? The Company in 1874 obtained another Act, section 22 of which was a rather peculiar one. It provided that no person should be entitled to require, nor should the Company be bound to furnish, a supply of water otherwise than by meter or by special agreement, to any dwelling-house where any part of it was used for any trade or business purpose for which water was required. The plaintiffs said that the housing and maintaining of paupers, though in one sense, no doubt, it would apply to a domestic matter, was a trade or business; and it had been so decided in a great many cases. The most important was that known as the Marylebone case, tried before Mr. Justice Buckley, who held that maintaining and providing for pauper children was a trade.* There was no doubt that in the present case it was a trade for which water was required; and the plaintiffs had all along said that, under these circumstances, and having the section referred to in their Act of Parliament, they were not bound to supply water to the workhouse otherwise than by meter or under special agreement. They admitted that, if there had been no such section, the workhouse might be said to be, in a sense, a dwelling-house; and in many instances it had been held to be so. In the Marylebone case, Mr. Justice Buckley distinguished the various purposes for which the water was used, and said that one was a domestic and another a trade purpose. But the defendants had not put themselves into a position to separate domestic from trade purposes, and therefore were not entitled to a supply for the former.

Justice JELF asked if it would be possible to divide the supply into two and to deal with them separately.

Mr. BALFOUR BROWNE thought that it might be possible, but it would be very difficult. The defendants, however, had not done so, and until they did they were not entitled to ask for a domestic supply. If the decision referred to was a good one, it was a trade purpose for

* See "JOURNAL," Vol. LXXXV., p. 636.

which the water was used in the present case; and therefore the plaintiffs said they were not bound to supply water otherwise than by meter or under an agreement. Anyhow, the defendants had the protection of section 47; and if they thought the Company's charge was unreasonable, they could go before two Justices and have the matter settled. At a certain date the defendants had given up using water for chopping wood; and this looked as if they were trying to divide their uses of the water between trade and domestic purposes. But they were still employing it in a number of ways which were clearly not domestic, apart altogether from the argument that the whole concern was a business or trade. They were using water for two Lancashire boilers, a ventilating-fan, for driving laundry machinery, and in other ways outside the ordinary idea of domestic purposes. In the case of *Pigeon v. Great Yarmouth Water-Works Company**, it had been held that a lodging-house was entitled to a domestic supply, though a business was carried on there; but in that case, the Company had not a section like section 22 of the plaintiffs' Act of 1874. Counsel then referred to other cases bearing upon the question, and reverted to that decided by Mr. Justice Buckley, where it was held that a school was a dwelling-house within the meaning of the Water-Works Clauses Act, and that, though a business was carried on there, the defendants might still be entitled to a supply of water for domestic purposes, though they must first comply with the reasonable regulations which the plaintiffs were entitled to make. He then read, and commented at some length upon, his Lordship's judgment.

Justice JELF said in that case the learned Judge seemed to be of opinion that there might be two separate supplies—one for domestic, and the other for non-domestic purposes; but it appeared to him that there would be very great difficulty in carrying this out.

Mr. BALFOUR BROWNE thought it would be really impracticable. His case was that the defendants were precluded by section 22 of the Company's Act of 1874 from being entitled to a domestic supply at all. In the case before Mr. Justice Buckley, there was no such section as that. Its object was to draw a broad distinction—that if any trade was carried on, an agreement must be made with the Company. There were distinct decisions that the maintaining of paupers was a trade; and therefore the defendants were only entitled to have a supply of water by meter or by agreement.

Justice JELF suggested that, before going into evidence, it would be well for him to hear the defendants' contention.

After some discussion as to the relief for which plaintiffs asked,

Mr. LUSH said he understood the plaintiffs put forward two main points—first, that it was a trade or business which was carried on on the premises in question; and, secondly, that, under section 22 of the Act of 1874, part of the premises were certainly used for trade or business purposes. To take the second point first, and looking carefully at the section, it was not merely because a trade or business was carried on on part of the premises that the prohibition of asking for a domestic supply was imposed; it was only where part was used for a trade or business for which water was required. If, under the pretence of getting a domestic supply, a trader occupied a room or two in the building, but used the other part for the purpose of carrying on a trade requiring water, then, under this section, he could not get a domestic supply. The distinction to be drawn was between requiring water for the inhabitants of a dwelling-house and requiring it for a trade or business purpose. Assuming for the moment—which, of course, he did not admit—that providing for paupers was a trade or business, it was quite consistent that the water for this business was water required for occupancy as a dwelling, and not for business *quâ* business. This was pointed out by Mr. Justice Buckley in the Marylebone case which had been cited. The important point in each case was not the character of the house, but the purpose for which the water was used. The case of a lodging-house was a good illustration of the difference.

Justice JELF said the point to his mind was whether any part of the house was used for a business for which a supply of water was required.

Mr. LUSH did not know in what respect any part of the workhouse was used for a business which required water independently of its occupiers.

Mr. Justice JELF said a goodly list had been given—two Lancashire boilers, a ventilating-fan, and laundry machinery. These were not ordinary domestic purposes.

Mr. LUSH said he did not dispute that there were some purposes for which the water was used which were not domestic. Section 47 spoke of some purposes being non-domestic and of the terms being settled by arrangement. For instance, with regard to the engines, they could, in order to get over the trouble of having separate meters, have a certain scale of charges for engines, charging so much per horse power. They were quite prepared to pay by the horse power for such of the engines as were held to be non-domestic.

Justice JELF said that this would be a compromise; but now that the parties were at law, he should have to deal with the case strictly on the terms of the statute.

Mr. LUSH quite agreed. He said his point was that section 22 carried the plaintiffs no farther. In the Marylebone case, the defendants had refused to comply with the reasonable requirements of the Water Company. In the present instance, there were no such conditions precedent. It was not a case where only a part of the house was used for business. So that section 22 did not really apply. The learned Counsel then referred to the judgment of Mr. Justice Buckley, and read certain passages to show that premises such as those in question were entitled to a domestic supply.

Justice JELF asked Mr. Lush if he was prepared to admit that these premises were carried on for business purposes.

Mr. LUSH said he was not. He was merely assuming it for this part of his argument. Assuming—not conceding—that a business was carried on in part of the workhouse, the purpose for which the water was required was not a trading purpose.

Justice JELF: Not the pumping-engines?

Mr. LUSH said certainly not, if the engines pumped water for the purpose of cleanliness. There were many purposes other than domestic which were not business purposes. The line of demarcation was not between domestic and trading purposes, but between domestic and other than domestic purposes.

Justice JELF said there appeared to be two baskets—one domestic and the other non-domestic. If they were not in the one basket, they must be in the other.

Mr. LUSH argued that if a trade was carried on for which water was required merely because it was a trade, then the supply would not be for a domestic purpose.

Justice JELF: But could you draw the water from one and the same pipe, sometimes to wash your hands and sometimes to set your engine going? If not, you would want two sources of supply.

Mr. LUSH contended that, assuming for the moment that this was a "business" within the meaning of the Special Act, the defendants did not want the water for business apart from the dwelling at all; they required the whole of the water for the occupants of the dwelling-house. Everything depended on the character of the purpose. It might be other than domestic; but it was not a business purpose.

Justice JELF said he could not agree with that.

Mr. LUSH submitted that the cases cited about schools and workhouses were decided under covenants not to carry on a business or suffer the house to be a nuisance, or something of that kind.

Justice JELF pointed out that Mr. Justice Buckley had adopted these decisions.

Mr. LUSH said the Marylebone case was a school for pauper children.

Justice JELF thought it made no difference whether it was a school for teaching pauper children or an institution for looking after old men and women; it was a public purpose.

Mr. LUSH submitted that the Guardians here were only discharging their duty in maintaining the paupers; and this was not correctly classified as a trade or business within the meaning of the section.

Justice JELF suggested that this gave the go-by to the judgment of Mr. Justice Buckley.

Mr. LUSH argued that, apart from the cases cited, the broad principle appeared to be that the domestic supply—namely, that required for the health of the public—was to be the first consideration, apart from trade or business; and that the water was not to be used for the latter purpose so as in any way to endanger the supply for the inhabitants. This principle, he said, applied quite as much to the inhabitants of a workhouse as to anyone else. The Company took up the position that the defendants were not entitled to a domestic supply, because of section 22; also that there was an agreement, and that one side could not break it. In 1901, the defendants told the Company they admitted that certain purposes for which the water was used might be non-domestic, and that they were willing to pay extra for water used for such purposes as might be agreed. But they insisted on the supply being a domestic one at the annual value rate. Learned Counsel then drew attention to the relief applied for in the statement of claim, part of which was an injunction to prevent waste, which he submitted the Company were not entitled to, on the authority of a decision of the Court of Appeal; and, lastly, he pointed out that they asked for a sum of money as damages for the use of water they had voluntarily supplied—a claim which he thought could not be supported.

A plan of the premises was put in, and also the interrogatories and answers, which set out the particular uses of the water which were alleged to be non-domestic, but some of which the defendants contended ought not to be so described.

Mr. RANDOLPH read some of the correspondence, beginning with October, 1876, when the Company informed the Guardians that the charge for water would entirely depend on the quantity consumed. This was accepted by them. In 1901 and 1902, the correspondence dealt with the question now raised; the Guardians having passed a resolution desiring the Company to remove the meter, and supply all water required for domestic purposes at the workhouse according to the annual value, under section 47 of the Act of 1857. The Company insisted on the existing agreement being still in force. It appeared that for the first year for which the Guardians had tendered £12 1s. 3d. the quantity used was 1,288,000 gallons, for which the charge on the meter rate was £40 odd. The figures for the next year were very similar. In a later letter, the plaintiffs called attention to the fittings, and alleged waste of water in connection with the closets. Matters went on; the Guardians sending cheques quarterly, which were returned by the Company. Ultimately, after many letters complaining of the wasteful character of the fittings, with certain letters making offers and counter-offers, which were written "without prejudice," one letter of June 15, 1904, connected with the others, was not so headed; and there was a long discussion as to whether it could be read. His Lordship decided that it could not. On the 6th of July the writ was issued.

Mr. *J. W. M. Richardson*, the Water Engineer of the Birkenhead Corporation, said he examined the fittings at the workhouse, and found that they were not suitable for a supply of water for domestic purposes on the annual value.

Mr. DANCKWERTS objected to this evidence.

Another discussion ensued; and his Lordship's opinion was that the evidence was not admissible.

Mr. RANDOLPH submitted that it was part of his case to show that the defendants were not in a position to claim a domestic supply of water.

Justice JELF said the witness must state the facts he had observed.

The witness then briefly described the mode in which the closets, urinals, &c., were flushed, under which any quantity of water could be used at the discretion of the defendants. He said it would not be easy or economical to have a dual system of mains and services, one for domestic and the other for non-domestic purposes.

Cross-examined: There was no absolute difficulty in having two separate systems, the expense of which, failing agreement, would fall on the consumer. There might also be a meter fixed on every branch pipe used for the non-domestic supply.

Re-examined: At present there was only one set of pipes, and there was no way of distinguishing between the purposes for which the water was used.

The case was then adjourned till next morning, when it was announced that his Lordship was unwell, and the further hearing was accordingly postponed indefinitely.

* See "JOURNAL," Vol. LXXVIII., p. 1390.

Tuesday, Dec. 18.

The case was resumed to-day, when

Mr. BALFOUR BROWNE began by saying he was prepared to prove that the defendants used the Company's water for the gardens.

Mr. DANCKWERTS admitted that a watering can was used, but not a hose.

Justice JELF said he did not think he could draw any legal distinction between the two.

Mr. BALFOUR BROWNE said he could also prove that payments were made to the Guardians by the relatives of some of the inmates of the workhouse.

Mr. *Francis E. Roberts*, the Chairman of the plaintiff Company, was then called, and stated that the firm he was connected with acted as Solicitors for the relatives of a woman named Holly, who resided in the workhouse; and they made a quarterly payment to the Guardians for her maintenance.

Cross-examined: There was a case in which the Company insisted on charging a butcher in Chester at the domestic rate for his shop, though he wanted to be supplied by meter. He used hardly any water at the shop, though his family lived there during the day. His slaughter house, where a good deal of water was used, was supplied by meter. Witness produced the plaintiffs' scale of charges, which stated that no charge was made for baths or water-closets.

Mr. *Bernard W. Bryan*, the Chief Engineer to the South Essex Water Company, said he had recently inspected the water-fittings in the Chester Workhouse. Water was used in connection with the feeding of the pigs, and steam was employed for heating the water with which their food was mixed. It would be impossible to secure that water for domestic supply was not used for trade purposes, and *vice versâ*.

Cross-examined: It would not be practicable economically to have a duplicate supply. The engineering difficulties were simply those of initial expense, which would fall on the defendants. But it would be absolutely impossible to prevent the domestic supply being used for non-domestic purposes.

Mr. *T. B. Farrington*, a water engineer, also gave evidence as to the purposes for which water was used in the workhouse. He could not agree with the evidence of Mr. Bryan as to the impossibility of having a duplicate water supply. It would be no more open to abuse than an ordinary domestic service. Where this occurred, offenders could be prosecuted.

Mr. *Wm. Turnock*, the Clerk to the Guardians, said they received no payments either from paupers or their relatives, except such as could be enforced by law. Water was only used in the mortuary house for cleaning purposes, and in the chapel for cleaning and heating. Down to December, 1901, the defendants had paid for the water by meter. In 1900, a deduction of 10 per cent. was made by the plaintiffs in response to an application—the consumption being over a million gallons. Their payments had averaged about £200 per annum. On Aug. 28, 1901, he sent to the plaintiffs the copy of a resolution passed by the Guardians, asking them to remove the meter and charge by rateable value. On Jan. 1, 1902, he sent a cheque in advance (calculated on the rateable value), which was returned; the plaintiffs insisting on the existing agreement. On Feb. 22, the Secretary of the Company wrote, in reply to a letter from him, that plaintiffs were advised that the agreement to take water by meter was binding; and on March 26 they sent a demand on the meter basis, which he returned. The same thing occurred in July. In November following, he received a letter asking for a payment on account generally. In March, 1903, the plaintiffs wrote complaining of waste of water in the closets. He brought the matter before the Board; and a Special Committee was appointed to inquire into it. Further correspondence ensued, and a deputation was appointed to wait on the Company, which he attended. So far as he remembered, the Company would not make any suggestion as to what should be done. In July, the Secretary wrote referring to an interview he had had with witness on the 9th. His recollection was that at that time the plaintiffs were willing that the matter should stand over until the legal question was settled, on condition that the arrears were paid and payments continued on the meter rate. He telephoned in reply, but could not remember what he said. Another meeting was arranged for Sept. 21, in reference to which Mr. Moss, the Secretary to the Company, wrote on the 28th offering a further reduction of 10 per cent., but still insisting on payment by meter, and again referring to an alteration in the fittings. Down to that time, the plaintiffs had never made any suggestion as to the alterations that they desired. In December, there was another letter referring to the fittings, saying there was a good deal of waste going on. Further correspondence ensued, being taken up in April, 1904, by the plaintiffs' Solicitors; and in June came the letters (without prejudice) about which there was a discussion on the former occasion.

Cross-examined: He collected a considerable sum—probably £250 a year—from the relatives of people in the workhouse. The rate at which they agreed for the water supply was the lowest charged to any one with a discount of 10 per cent. The plaintiffs had offered arbitration, which was declined. Defendants had never, to his knowledge, offered to provide a duplicate supply, or to put in separate meters.

In re-examination, witness said the Company had all along insisted on payment by meter, according to the agreement. He maintained there was no agreement.

John Benyon, who had charge of the whole of the water-fittings at the workhouse, next gave evidence. There was a steam-pipe in connection with the piggeries, which was connected about a year ago for the purpose of boiling water for the pigs' food. He described the various ventilating and drying fans used at the laundry and for other purposes, and the engines employed in connection with them. Rain water was used for washing when available. There were eight trough closets; and each range was separately flushed by a 1¼-inch screw-down valve, which no one but himself was allowed to use.

Mr. *Farrington*, recalled, said the fittings were first-class, and in excellent condition. The description of the trough closets as given by Benyon accorded with what he saw. It was not a wasteful method. The daily consumption of water at the workhouse, taken over several years, was from 28 to 38 gallons per head.

Mr. BALFOUR BROWNE: The average consumption in Chester is 35·5 gallons per head.

Witness said in some parts of Chester it was 50 gallons per head; 33 gallons for a workhouse was not at all a large consumption.

Mr. *Rowe Morris*, the Chairman of the Board of Guardians in 1904-5, said he was present at a meeting of the Directors of the Water Company on Sept. 21, 1903. It was an informal meeting, and no minutes were taken. The Guardians asked the Directors to point out any defects they complained of, or to send their Engineer; but they did not do either. There was a subsequent meeting in May, 1904; but again no definite complaint was made as to the fittings.

Mr. DANCKWERTS then addressed his Lordship on the law of the case, as well as on the facts. He said that when the defendants, in 1901, claimed to be supplied on the rateable value for domestic purposes, the question of trade uses never really arose, because the plaintiffs met them *in limine* by the contention that they were not entitled to a supply at all on those terms; so that they never got to close quarters as to what were or were not domestic purposes, or how water used for non-domestic purposes should be paid for. The Company throughout insisted upon the original agreement of 1876 being still in force. This position they continued to hold down to the present time; and he should contend it was still put forward on the pleadings. He then referred to the case of *Metropolitan Water Board v. New River Company* (where the question was whether the New River Company were subject to the 10 per cent. limit of dividend), and cited a passage from Lord Macnaghten's judgment in the House of Lords, to show that Water Company's Acts should be construed strictly against the undertakers, and liberally in favour of the public. One had, he submitted, to look to the purpose to which the water was to be put, not to the character of the premises in which it was used. The first class was domestic purposes, which word had acquired, by decision, a technical meaning; the second, commercial purposes; the third, public purposes; and the fourth, anything not included in the other three. Public purposes were obvious—flushing and cleaning the streets and sewers and extinguishing fires; commercial, anything in the nature of trade; and the fourth class included ornamental purposes and such as had been excluded from the domestic class, such as watering gardens, animals, and, in some cases, swimming baths. There was no definition of domestic purposes except by way of exclusion. In *Bersby v. Chesterfield Water Company*, water used in a stable and coach-house was held to be for domestic purposes. In *Bristol Water Company v. Uren*, it was held that a garden and pleasure ground were properly included in assessing the water-rate, but that a special charge might be made for using a hose. In the Liskeard case, which had been frequently approved, it was held that water could be required to be supplied to a workhouse for domestic purposes, as being a dwelling house. In *Smith v. Miller*, a boiler used to supply hot water to offices was held to be a domestic boiler. In *Pigeon v. Yarmouth Water-Works Company*, it was held that the occupier of a boarding house was entitled to a supply for domestic purposes at the usual rate; the defendants contending that it was required for trade purposes. The learned Counsel, having commented on these cases, went on to deal with that of *Barnard Castle Urban District Council v. Wilson*, where a swimming bath in a school, where swimming was taught and specially charged for, was held not to be within domestic purposes. He suggested that in former times baths of any kind were rare, and probably the clause in some Acts allowing an extra charge for baths was a survival from those early days when baths were looked upon with suspicion. He then took the case before Mr. Justice Buckley of the *South-Western Suburban Water Company v. Marylebone Union*, which he discussed at some length, and had not concluded when the Court rose.

Wednesday, Dec. 19.

On the resumption of the proceedings this morning,

Mr. DANCKWERTS continued his argument, and stated, in answer to a question put by his Lordship the previous day, that he could point out several cases in which water had been supplied for both domestic and non-domestic purposes to the same premises. It was a well-known practice to have two separate supplies, and in other cases it was combined. For instance, the present plaintiffs gave a combined supply to public houses in Chester, charging the domestic rate *plus* 25 per cent. to cover the trade use. Having read a great portion of Mr. Justice Buckley's judgment in the Marylebone case, he cited a number of other cases, including *Cooke v. New River Company*, and then went on to submit that the purposes to which the water was put by the defendants were not in the nature of a business, even if they did not come within the description of domestic. Several cases were referred to in which the word "business" had been held to mean what was done for the purpose of making a profit, and his submission was that neither the laundry nor the piggeries came under that category—they were merely incidental to the proper management of the workhouse. He then went through the Water-Works Clauses Acts and the Company's Acts, and discussed the various provisions therein contained in some detail, for the purpose of showing, among other things, that the Company were adequately protected against waste or misuse of water. A considerable amount of discussion took place on the special clause in the plaintiffs' Act, which provided that no one should be entitled to demand a domestic supply to a house in which, or in any part of which, a trade or business was carried on; Mr. Danckwerts contending that any non-domestic use did not necessarily come within that clause. On the whole, he urged that it would be an intolerable hardship if the Company could refuse a domestic supply under such circumstances when they were amply protected in other ways. He again referred to the plaintiffs' published scale of charges, according to which closets and baths were included in the domestic supply without extra charge. He further submitted that, if necessary, he was entitled to treat different blocks of buildings as separate houses; the piggeries, for instance, could not be treated as part of the house. Having briefly alluded to certain topics which he said had been introduced for the purposes of prejudice—such as the suggestion of arbitration which the plaintiffs themselves had said would not be satisfactory, and that the rateable value was fixed by the guardians themselves—he concluded a long argument by discussing the facts of the case in the light of the propositions he had endeavoured to establish. With regard to the two Lancashire boilers, he contended that they were only partially used for non-domestic purposes. He admitted that the engines were non-domestic; but he denied that the

pigs were kept for sale. With regard to watering the gardens, if they were included in the annual value, they were entitled to use water for them. The Company could, however, charge separately if they preferred, but then the annual value would have to be proportionately reduced. The use of water in the surgery, in the church, and in the mortuary, he submitted could not be treated as other than domestic. After referring to the correspondence between the parties, he submitted that the defendants were entitled to determine the agreement at any time after the first three years, and that the plaintiffs had themselves considered that the whole supply, except that for extinguishing fire, was domestic. Various points on the pleadings were then dealt with; and it was submitted that, under the Statute limiting the liability of guardians of the poor, the plaintiffs could not recover a greater amount than represented nine months' consumption before the writ was issued.

Mr. BALFOUR BROWNE then replied. In his view, the case had been overlaid with an immense amount of irrelevant matter and legal decisions which did not affect the question; and he should not refer to them. He repudiated his learned friend's division of the use of water into four categories; the only distinction drawn in the Acts being between domestic and non-domestic. It had been held that a stable was part of a house, and that the whole tenement had to be considered as one, and not as separate buildings. He submitted that practically two supplies were out of the question, though physically such a thing might be possible if expense were no object. He agreed that there might be public institutions that were held to be in the nature of a business which had a domestic supply; but in the present case, section 22 of their Act of 1874 got over that difficulty by saying: "No person shall be entitled to require, nor shall the Company be bound to supply, any dwelling house with water otherwise than by meter or by special agreement, if any part of such dwelling house is used for any trade or business purpose for which water is required." This was a complete answer to the defendants' case. It had been held by Lord Justice Buckley that carrying on a workhouse was a business, and the Company were therefore not bound to supply except by agreement; the consumer being protected by his right to appeal to two Justices as to the reasonableness of the terms. Apart from section 22, he admitted that the plaintiffs could require a supply for domestic purposes. Apart from the maintenance of paupers—which was held to be a business—he had only to show that any trade or business was carried on in any part of the premises to entitle him to take advantage of this section; and the keeping of pigs for sale was ample for the purpose. It was perhaps putting it too high to say that the old agreement was still in force; but he put it upon an implied contract to pay for the water at a reasonable price, and the agreement was evidence of what that reasonable price was. In the same way, he got rid of the point raised about the limit to which they could recover, because he put it as damages for waste of water. He further pointed out that the plaintiffs had never approved of the fittings as being suitable for a domestic supply; and the defendants had therefore never put themselves in a position to require it. The question of the statute of limitations was not of primary importance, the real question being the rights of the parties; and with regard to that, he relied on section 22.

Mr. RANDOLPH having explained his view of the statute of limitations, and why he had included a claim for damages founded on an Irish decision of *Corporation of Dublin v. Dublin Guardians*,

Mr. LUSH pointed out that if it were damages for a tort, there was another statute which put a closer limit upon the time than that named by his learned friend.

Justice JELF said he must consider his judgment.

A Case for an Engineering Expert.

A case recently came before Mr. Justice Channell, among the commercial summonses in the King's Bench Division of the High Court of Justice, which his Lordship confessed he was unable to try, in consequence of its complicated and technical character. It was an action brought by Messrs. Fielding and Platt, of Gloucester, against Messrs. Saxby and Co., of Chippenham, in regard to the sale of certain gas-engines and gas-producing plant for £1350. Mr. Hamilton, K.C., and Mr. Bailache appeared for the plaintiffs; Mr. Scrutton, K.C., and Mr. Leek represented the defendants. Mr. Hamilton stated that the plaintiffs' case was that the plant was duly supplied, and the defendants had paid £1001 5s. 4d., but they declined to pay any more, setting up as their defence that the goods were not delivered within the specified time, that they were not up to the specification, and that some of them were unfit for the purpose for which they were intended. Defendants also set up a counter-claim, alleging that they had sustained damages by reason of the engines not being as they should have been. Counsel said the substantial answer to the claim was the alleged delay, which the plaintiffs admitted up to a certain point only. It was alleged that the gas-engines had not worked satisfactorily, and that the plaintiffs were bound to rectify them. The contract entered into was for the lump sum of £1350; but the defendants said they had incurred £1000 damages, which they claimed, less some £300 due to the plaintiffs under the contract. Plaintiffs had made certain payments into Court, some with and some without a denial of liability. Personally, he did not see how his Lordship could try the question, as it was complicated; and, so far, they had not been able to agree to a reference. Probably, however, his Lordship could try the question as to what the contract was. Plaintiffs alleged, and defendants denied, that by virtue of one of the clauses, which engineers often put into contracts, they would not replace breakages; they were not therefore liable. After hearing the evidence, his Lordship said he could not try the case, and referred it to an engineer.

A portion of the roadway in Cheapside was damaged on Christmas Day by the bursting of a water-main belonging to the Hydraulic Power Company; the water making its way under the asphalte surface, and forcing it bodily upwards. It is stated that it will be necessary to repave the road, as the asphalte coating was forced right away from its concrete bed.

MISCELLANEOUS NEWS.

NOTTINGHAM GAS CONTROVERSY.

The Presidency of the Midland Association.

No reply has yet been received to the Nottingham Corporation's request for the intervention of the Local Government Board in relation to the gas controversy. But in the meantime there have occurred developments significant of petty spite on the part of certain of the Committee responsible for the control of the municipal undertaking. It seems incredible that, in an age when honour to be paid to a responsible official should be regarded logically as an honour also to a corporation, obstacles should be placed in the way of the fulfilment of an arrangement which would cost the ratepayers nothing.

When Mr. J. H. Brown, the City Gas Engineer, was invited in 1905 to undertake the Vice-Presidency of the Midland Association of Gas Managers, the request was brought to the notice of the then Committee, with the result that there was no objection raised. But now the full honour of the higher position in succession to Mr. F. W. Stevenson, of Coventry, has been suggested, the pettyfogging spirit of "How much time will this mean away from Corporation work?" has come into evidence. The upshot is that Mr. Brown has intimated that, under the circumstances, he can neither undertake the office nor proceed with arrangements for welcoming a body of representative men to the city. It must to the credit of the Municipality be recorded, however, that the Committee, in the sense of a majority, were not opposed to an arrangement in relation to an office which probably would not have entailed during the year more than four days of partial absence from official work. Maladroitness is a somewhat heavy word for representing would-be clever tactics; but the design was personal in antagonism to the Engineer, and the failure to permit the carrying out of the arrangement under which the members of the Midland Association were to visit Nottingham this year, exhibits a narrowness of view which, when the whole of the facts underlying the controversy are made public, is not calculated to redound greatly to the credit of individuals who at this juncture need not be specifically named.

PRESENTATION TO MR. ARTHUR ANDREW.

On Friday, the 21st ult., Mr. Arthur Andrew, the General Manager of the Oldham Gas and Water Works, was presented with a handsome solid silver tea service, in recognition of his completion of forty years service with the Corporation. The gift has been subscribed for by his colleagues, and was presented in the Alexander Hall in the presence of a company numbering about 150. Mr. Tim Duxbury, the Gas Engineer to the Corporation, presided.

Mr. Andrew commenced his career as a clerk in the gas and water offices. He was afterwards appointed to more responsible posts, and eventually became the Accountant. In 1894, the position of Superintendent and Secretary was rendered vacant through the death of his brother, Mr. Herbert Andrew, and he succeeded him. Since then Mr. Andrew's official designation has been altered from Superintendent to General Manager. Since his appointment he has seen the departments of which he is the head grow to an enormous extent. In 1866, when he was first employed in the office, the amount of cannel and coal used per annum was 20,000 tons; whereas it is now 120,000 tons. In 1866, the total quantity of gas made was 214 million cubic feet; now it is 1318 millions. The number of gas-meters then was 13,000, against 51,000 to-day; and the quantity of gas supplied to the public lamps was only 21 million cubic feet, compared with 86 millions now used in lighting the borough. In the earlier year named, the price of gas was 3s. 8d. per 1000 cubic feet; now it is only 2s. 2d.

In opening the proceedings, the Chairman said they were assembled to do honour to one of their officials who had served forty years under the Corporation; and, so far as he knew, Mr. Andrew had served them for those forty years conscientiously and faithfully, and had certainly performed his duties creditably and to the best of his ability. It was fully realized that the success of the town depended to a large extent on the ability and integrity of its public officials, who were specially trained for the particular branch of work they had to do. The members of the Council could never be expected to have the technical knowledge of official experts. Oldham was a great and important county borough, and the duties of its public officials were also great and important. Mr. Andrew was an honest, straightforward, conscientious official of the Corporation, and of the Gas and Water Committees in particular. He fought for his own Committees as though fighting for his own interest, and he (Mr. Duxbury) admired him for doing so. Had it not been for him, there would sometimes have been no profit at the end of the year, as other Committees were always ready to appropriate the profits of the Gas Committee; and it was only fair that he should be given credit for having done good work for that Committee. They could not have a better official at the head of the department than Mr. Andrew.

Mr. H. Gartside then made the presentation, for the Presentation Committee, and hoped Mr. Andrew might live long to enjoy it.

Mr. Andrew, in acknowledging the gift, said he was never in a position of greater embarrassment in his life before. He could not see that there were any solid reasons for honouring him. It was true he had had the honour and privilege of serving the Corporation for forty years. But he was not the only one who had done so. The mere fact of having served them for forty years did not, in his opinion, warrant such a demonstration of friendship as the present. He appreciated it more than the intrinsic value of the gifts. He had served the Corporation to the best of his ability; more he could not do. One main reason had contributed to his achieving some measure of success. He

had to serve two Committees who had given him every consideration. Whenever he had made mistakes—and he would not say he had not done so—they had been mistakes of judgment; but he had never had a disagreeable word from the Committees since he began to serve them. They had given him their fullest confidence, and he had appreciated it; and knowing that he had it, and also a measure of responsibility which did not often rest on a public official, it made him work harder in order to deserve that confidence. He must give credit to the staff of which he happened to be the head; for a better or a more hard-working staff there could not be. From the foreman down through every grade, all tried to do their duty. He did not know that, in the course of his long experience, he had ever had a better staff; otherwise his duties would have been much more difficult. He believed some members of the Corporation thought there was a spirit of antagonism between the Gas and Electricity Committees. This was an entirely mistaken idea. There was room for both undertakings; and he hoped the same measure of success would attend the work of the Electricity Committee as had attended that of the Gas Committee. Many members of the Corporation did not realize the magnitude of the gas and water undertakings; but they were spread over an area equal to four times that of the municipal borough they had to supply. In accepting the presents, he again thanked his fellow-employees for them.

Alderman Johnson (the Chairman of the Water Committee) fully endorsed what had been said by the previous speakers in reference to the services of Mr. Andrew. He always admired his business methods, and particularly the carefulness with which he dealt with the finances of the Water Department. He thought a department of such magnitude as the Water Department should be worked on strictly business lines; and Mr. Andrew had always striven to so conduct it, in spite of the criticism to which he had been subjected. He was pleased to see so many present, and he thought it augered well for the success of the department when it possessed such a large and intelligent staff of workmen. He congratulated Mr. Andrew on his faithful services, and hoped they would be long available.

Mr. Thompson, the Vice-Chairman of the Gas Committee (the Chairman having had to leave), expressed his pleasure in testifying to the integrity of Mr. Andrew during the few years he had been connected with the Gas Committee. Mr. Andrew thoroughly understood the work of the department; and this was one reason for its splendid success. In conclusion, he hoped Mr. and Mrs. Andrew would live long to fully enjoy the handsome presents which had been made to them.

The proceedings were enlivened by music, and Mr. Andrew, in moving a vote of thanks to the Chairman and the artistes, thanked the different members of the Gas and Water Committees for their presence, which he took as an honour to himself.

Mr. J. Wild (the Vice-Chairman of the Water Committee) seconded the vote, and paid a tribute to Mr. Andrew, who, he said, had served the Corporation as no other man had done. Labour and capital could work in unison if good feeling and good understanding existed. Mr. Duxbury briefly responded, and the proceedings closed.

PROGRESS OF GAS SUPPLY IN PERTH.

Mr. Thomas Whimster's Work.

Some days ago, the "Dundee Evening Telegraph and Post" published, along with a photo., the following interesting particulars in regard to the work of Mr. Thomas Whimster, who was many years Manager of the Perth Gas-Works.

To the older section of the community of Perth, the figure of Mr. Thomas Whimster, York Place, ex-Gas Manager for the city, is a familiar one. Mr. Whimster is, indeed, one of Perth's grand old men; and he may be seen any day taking his constitutional, his frame still wonderfully erect, despite the burden of 87 years. A native of the Kingdom of Fife, Mr. Whimster was born in Kinghorn in the year 1819; but his youth and early years were spent in Dundee. It was in Perth, however, that Mr. Whimster was to achieve his best work; and his connection with the manufacture of gas in the Fair City was as long as it was honourable. Mr. Whimster was born before the streets of the ancient capital of Scotland were lit by gas. It was not until 1824—five years after the birth of the subject of our sketch—that a Company was formed for the supply of gas in Perth by the late Mr. George Gray, of Bowerswell, a gentleman who acted as Secretary until the undertaking was purchased by the Gas Commission in 1871. If the quality of gas in the country, as is sometimes alleged, has decreased with the passing of the years, so also has the price. In 1827-8, the price charged for gas in Perth was 12s. 6d. per 1000 cubic feet, and when Mr. Whimster came to Perth, it was 7s. 6d. per 1000 cubic feet; while this year the same quantity can be secured for 2s. 9d. In the early days of gas manufacture, however, better coal was used; and 30 candles was the average illuminating power of the gas of that period. No enrichment was resorted to; hence the greater purity and quality of the gas. In fact, Perth was for years noted for the high illuminating power and purity of its gas; and the Fair City was even visited by parties about to construct works in other towns.

When Mr. Whimster first of all came to Perth, there were two Gas Companies; and they each made about 12 million cubic feet of gas a year. But when Mr. Whimster retired in 1895, 124 million cubic feet a year was manufactured. Mr. Whimster, during his long connection with the manufacture of Perth gas, saw many important improvements effected in the works. Under his careful management, a great improvement was made in the reduction of gas unaccounted for or set down as "leakage." The steps leading up to the Town Council erecting new and more spacious gas-works at the Friarton are well known to the inhabitants of the Fair City. As far back as 1881, and again in 1884, Mr. Whimster reported on the dangerous condition of the gas-works and the inadequacy of the supply. In 1895, after a continuous service of about 45 years, Mr. Whimster retired from the gas managership; and on that occasion, appropriate and fitting testimony was paid to his sterling character, his capacity as a gas manager, and the painstaking and thorough manner in which he performed his duties. Again at the opening of the new gas-works at the Friarton, erected at a cost of something like £45,000, the Corporation showed their appreciation of Mr. Whimster's long services by presenting him with a silver salver, bearing a suitable inscription. A keen student of passing events, and singularly alert mentally for his years, Mr. Whimster continues to take a lively interest in the welfare of the community. In politics, he is a keen Radical, and was a great admirer of the late Sir John Leng. That Mr. Whimster may yet have many years to enjoy his well-earned retirement, is the hope of numerous admirers.

SERIOUS FIRE AT MILTON HOUSE WORKS, EDINBURGH.

On Saturday, the 22nd ult., between nine and ten o'clock in the morning, a fire broke out on the premises of Messrs. James Milne and Son, Limited, Milton House Works, Edinburgh, which resulted in the total destruction of the portion of the buildings devoted to the brass-finishing and art-metal work and the metal store—roughly about one-third of the entire establishment, and employing about 200 of the 600 or 700 hands in the service of the firm. The works cover about three acres of ground, in the shape of a rough triangle; and the buildings burnt out formed a large block running from the centre of the area to the south-west side of the triangle. Between the brass-finishing works and the back of the west side of the Milton Street houses lies another block of about equal size, consisting of general warehouses and the gas-meter department; but in the fortunate absence of wind, the outbreak did not threaten the adjacent buildings, and was no source of danger to the neighbourhood. While thus fortunately confined to the building in which it originated, the fire was not without danger to life; and four girls, who first became aware of the occurrence, had what seems to have been a narrow escape of serious consequences. It is supposed that the fire broke out in the tool-shop, at the bottom corner of the building, which consisted of a main lower floor and galleries. The four girls, who were employed during the men's breakfast hour in the lacquering-shop on the gallery above the tool-house, became alarmed at a smell of fire; and noticing that the flooring beneath their feet was burning, they made a rush for safety, and were quickly got out of harm's way. The timekeeper sounded the alarm whistle, and three of the Directors (Messrs. Macfie, Lumsden, and Oliver) happening to be in the offices adjoining, the fire-extinguishing apparatus on the works was started in a few minutes. The alarm was communicated to the fire station, and this quickly brought a detachment of firemen on the scene. It was evident that the brass-finishing department was doomed. As the outbreak subsided almost as quickly as it began, the workmen returned from breakfast to find only blackened walls in place of the building they had left in apparent safety not an hour before. The extent of the damage is very considerable; but it is stated to be entirely covered by insurance. The firm has been in existence since 1750, and this is only the second large fire in its history. It will be seen from an announcement which appears elsewhere that the fire was confined to the brass-finishing department; so that the other departments are in full operation.

GAS SUPPLY IN THE UNITED STATES.

In the "JOURNAL" for the 3rd of July last, we gave some statistics relating to gas manufacture in the United States, extracted from a document which had recently been issued by the Census Bureau. The figures related to the year ending Dec. 31, 1904, and they were admittedly preliminary. The Official Bulletin has since been published, and the following additional particulars have been taken from it by our contemporary "Progressive Age."

	Quantity.		Value.
Materials used—			
Coal . . . . . tons	4,431,774	..	$14,607,485
Oil . . . . . gallons	403,263,738	..	14,539,585
Water . . . . . ,,	5,430,361,158	..	253,895
Coke . . . . . tons	435,534	..	1,602,761
All other materials . . .	..	..	6,176,340
Total		..	$37,180,066
Products—			
Coal gas, straight . . . cub. ft.	12,674,033,691	..	$12,868,604
Water gas, straight . . . ,,	715,550,006	..	832,440
,, carburetted . . ,,	54,687,118,030	..	48,071,180
Coal gas and water gas mixed ,,	40,980,413,950	..	45,605,263
Oil gas . . . . . ,,	3,397,456,873	..	5,141,460
Acetylene . . . . . ,,	7,880,666	..	104,267
All other gas . . . . . ,,	24,329,932	..	39,354
Total	112,486,783,148	..	$112,662,568
Coke-oven gas sold . . . cub. ft.	3,882,800,400	..	684,464
Gas-works coke . . . . bushels	89,146,434	..	5,195,461
,, ,, tar . . . . gallons	67,515,421	..	2,064,343
All other products	..	..	972,992
Receipts from appliances	..	..	4,249,581
Management—			
Number of establishments reporting .	1019	..	..
Capital	..	..	$725,035,204
Salaried officials, clerks	9,406	..	8,463,699
Wage earners	30,566	..	17,057,917
Miscellaneous expenses	..	..	20,557,273
Value of products	..	..	125,144,945

Of the residuals consumed in the works where produced, there were 46,561,185 bushels of coke, 14,772,378 gallons of tar, and 1,363,756,761 cubic feet of gas. Of coke, the beehive ovens produced 22,522,152 short tons and the bye-products ovens 2,216,783 short tons; while from both together were recovered 23,074,225 gallons of tar, 26,050,713 lbs.

of sulphate of ammonia, and 4,339,679 gallons of ammoniacal liquor. Of the bye-products coke-oven gas sold, 3,747,408,300 cubic feet of it was for illuminating purposes and 135,392,100 cubic feet for fuel.

In the portion of the document dealing with gas machines and meters, 89 establishments reported $5,601,157 of capital, 345 salaried employees, 2674 workmen, $557,635 as miscellaneous expenses, $2,612,907 as cost of material, and $5,630,975 as the value of the products. The gas and lamp fittings makers reported 263 establishments, $20,206,957 of capital, 1239 salaried officials, 8141 wage earners, and $2,129,315 of miscellaneous expenses, materials costing $7,395,207, and products valued at $17,560,386. There were 66,882,962 barrels (42 gallons) of crude petroleum refined, producing 26,897,984 barrels (50 gallons) of illuminating oils, 7,281,584 barrels of fuel oils, 2,514,198 barrels of residuum, and 5,811,289 barrels of naphtha and gasoline. The coal-tar distillery products amounted to $340,641, from which $504,176 worth of products were made. Of crude wood alcohol, there were 6,684,871 gallons made, valued at $2,161,813.

LINCOLN WATER SUPPLY.

Great satisfaction has been caused in Lincoln at the receipt of a favourable report from Professor Hull with regard to the Boultham deep bore. It will be remembered that a short time since it was feared, owing to the analyses of the water from the bore, that its hardness and the excessive proportion of salts would render it unsuitable for drinking purposes, unless it underwent expensive treatment.

The bore has already reached a depth of 2015 feet; and in his latest report, Professor Hull (who has acted as the Corporation's Geological Adviser) says he agrees with Mr. Percy Griffith, the Engineer, in thinking that the bore should be carried further down into the sandstone, in which case it may happen that a similar conglomerate to that at Gainsborough may be proved, with the result of bringing an accession of fresh water. The contract for the boring is for a depth of 2200 feet; so that there is an additional depth of 185 feet remaining unproved. It is, he thinks, very desirable that this rock should be penetrated. Only one danger is to be avoided—that of passing out of the new red sandstone into the permian. The specimens brought up will therefore require examination from time to time in order to avoid this danger. In conclusion, he observes, as a source of confidence, that, as the impure waters are being drawn out from the boring at Boultham, they are being replaced by purer waters flowing in from the west. He considers that all underground waters drawn from beyond the valley of the Trent are, in the ordinary sense, fresh; while the objectionable salinity gradually augments in an eastwardly direction. Withdrawal of the saline waters necessarily causes an advance of the purer, owing to the eastward dip of the strata and the hydrostatic pressure. It is this conclusion, which seems to him absolute, that should, he urges, give confidence in the ultimate success of the operations.

The Water Committee have decided to request Professor Hull to meet them as early as possible to consider the whole question, and decide what the depth of the bore shall be.

Canterbury and Incandescent Gas Lighting.

Referring to public lighting matters, Mr. Dean informed the General Purposes Committee of the Canterbury City Council that he had approached the Gas and Water Company in regard to the lighting of certain streets where gas was still in use for this purpose. He had ascertained that the Company were willing to convert the existing gas-lamps of the city into incandescent lamps at their own expense, if the Council would give them an undertaking that they should remain for a period of not less than three years. The Company, of course, would be repaid by the smaller consumption of gas. He had a number of facts to lay before the Lighting Committee at their next meeting; and he asked that in the meantime the Engineer of the electric light works should be instructed not to make any further purchases of cable. The Chairman of the Lighting Committee (Alderman Mason) remarked that, so far as the buying of cable was concerned, they had studiously avoided making any purchases while the price of copper was so high. He wished to say, further, that any offer on the part of the Gas Company must be received from the Company themselves, and not through any individual member of the Corporation. Any recommendations which might reach them in this manner they would be most pleased to consider. Alderman Hart stated that this was the first time that he had heard anything on the subject. Seeing, however, that a new agreement for public lighting must shortly be entered into, he thought there was no reason why the question should not be considered; and he would suggest that the Directors should be asked to arrange for something of the kind. Mr. Godden said they were all prepared to accept any statement which Mr. Dean might put before them, and to consider it carefully; but he would want some strong arguments to induce him to hand over their business to another competing authority. The matter then dropped.

Bilston Gas Company.—In the report which the Directors of this Company will present at the annual general meeting next Monday, they state that the profit and loss account, after paying the usual interim dividends, shows a credit balance of £6373. It is proposed to pay further dividends of 5s. 6d. each on the "A" shares, and 4s. each on the "B" shares (making, with the interim dividends, 11s. and 8s. per share respectively for the year), and to carry forward the balance of £3688. The Directors express deep regret at reporting the loss the Company have sustained by the death of Mr. Joseph S. Reeves, who had been in their service for 43 years, during 33 of which he was Secretary and Manager, in which position he gained the respect and esteem of all with whom he came in contact. The Directors announced the appointment of Mr. W. H. Adams, late Manager of the Gosport Gas Company, as Engineer and Manager, and Mr. A. Bradford Legg, as Secretary, *pro tem.*

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

As usual, I preface my last "Notes" for the year by a few reminiscences regarding the doings which have come under review. There is nothing very outstanding to narrate. The year has been one of steady work, with the normal advance quite sustained, and, fortunately, without any disaster, financial or otherwise. In nearly every instance the financial year ended with a positive improvement in the matter of output of gas, though in some cases the revenue was down, owing to reductions in price. Thus, it may be noted, the increased output at Aberdeen was nearly 26 million cubic feet; at Alloa, nearly 8 millions; at Arbroath, 3½ millions; at Coatbridge, nearly 12 millions; at Dundee, 42 millions; at Dunfermline, 5 millions; at Edinburgh, over 8 millions; at Falkirk, over 20 millions; at Glasgow, over 255 millions; at Hamilton, 8½ millions; at Greenock, over 26 millions; at Kilmarnock, 1½ millions; at Kirkcaldy, nearly 5 millions; at Paisley, 14½ millions; and at Stirling, nearly 7 millions. Reductions in price were pretty general during the year; quite a common feature being that, while the price remained stationary to ordinary consumers, reductions were made to users for power, cooking, and heating purposes. The principle of charging differential prices for gas has thus obtained a much wider adoption than it had before. Of about 245 gas undertakings in Scotland, 64 charge lower prices for these purposes; while a number of others give discounts to large consumers, which is another form of the differential rate. Thus nearly a third of the undertakings are working under the differential principle, by which large proportion the success, or otherwise, of the system should be well tested.

Reductions in illuminating power have been made in more than one place, notably in Edinburgh, where the Gas Commissioners have sanctioned experiments being made with gas of as nearly as possible 20-candle power—the statutory minimum; the former standard having been from 24 to 26 candles. This movement seems to be giving the death-blow to schemes for enrichment, which are seldom heard of now. Though undoubtedly there are oil gas and benzol processes operating in a number of gas-works, little is said about them, from which the inference may be drawn that they are not holding their own in the race. The cheapening of gas has already had the effect of checking the inflow of electricity, as instances of which may be mentioned the two circumstances that in Coatbridge the Corporation gave up the partial lighting of the streets by electricity, and reverted to gas, supplied by the Coatbridge Gas Company; and that there were no registrations of any new companies for the supply of electricity for lighting purposes. Four companies supplying gas were registered, all of them small. If companies are too prosperous to feel the necessity for placing themselves under the Companies' Acts, the measure of prosperity which is attending the management of corporation undertakings has led to an extension of the practice of appropriating gas surplus revenues for town purposes. Hitherto the Corporations of Paisley and Arbroath have been the only municipalities in Scotland to follow this practice—a questionable one at the best; but this year the Corporation of Greenock voted £1700 of gas surplus to the general purposes of the burgh, and the Corporation of Perth obtained legislative power to so appropriate £250 a year.

New gas-works were opened at Edinburgh in October, at Gourock in March, at Falkirk in May, and at Kelty in February; and gas-works were very largely reconstructed at Airdrie, Newton-on-Ayr, East Wemyss and Buckhaven, and Campbeltown. At present, new works, for a recently started Company, are being erected at Polmont.

In May, the transfer of the Grangemouth Gas Company's undertaking to the Corporation was accomplished. In Lanark, negotiations for transfer have been interrupted by the death of Mr. J. M'Gilchrist, who was the Adviser of the Company. The Town Council have procured a report upon, and valuation of, the undertaking from Mr. W. R. Herring, of Edinburgh, and have agreed to postpone further negotiations to allow the Gas Company to consult an expert. At Sanquhar, a transfer has been effected; but as the ratepayers have yet to be consulted, a firm of Law Agents have, at the request of the Town Council, taken interim possession. Notice of motion has been given in the Lochgelly Town Council for consideration of a proposed transfer of the undertaking of the recently formed Gas Company there. The Town Council of Fraserburgh have had circulated among them for consideration a report by the Town Clerk upon the subject of a transfer there. A Committee of the Selkirk Town Council have been appointed to confer with the Directors of the Gas Company with a view to a transfer. Proposals for transfers were rejected, on polls being taken, by the ratepayers of Barrhead and Dunblane.

A question as to the legality of the purchase of coke from the gas-works by two members of the Corporation was raised in the Paisley Town Council. The opinion of the Lord Advocate for Scotland was taken upon it, as a result of which one of the Magistrates implicated resigned his seat in the Council, and the other was unseated by vote of the Council. The question was then raised in the Town Council of Glasgow; and a ruling was obtained from the Town Clerk, which was to the effect that the purchase of coke by a member for his own purposes, at market prices, would not be illegal, but that it was safer not to purchase, except from a coal merchant in the open market.

Of litigations relating to gas-works, the most important has been that with reference to the pollution of a brewery well in Edinburgh, which is making but slow progress, and is still apparently far from being concluded. There was another litigation, in the Sheriff Court at Hamilton, in which the question was as to the right to cut off the gas supply of a consumer who complained of an overcharge; and it was decided entirely in favour of the gas undertaking. In the Glasgow Sheriff Court this week, Sheriff-Substitute Fyfe declined to interdict the Corporation from cutting off the supply of gas and electricity to premises owned by a Company who were in arrears with their payments. The Sheriff proceeded upon the view that the Corporation had statutory powers to cut off, and could not be interdicted.

During the year, very successful exhibitions of gas appliances on a large scale were held at Aberdeen and Dundee.

New appointments were made as follows: Mr. John M'Gilchrist, to

Gourock; Mr. J. D. Keillor, to Lochgelly; Mr. John Ireland, to Tayport; Mr. A. Lobban, to Auchterarder; Mr. J. G. M'Geachin, to Dumbarton; Mr. W. Ritchie, to Peterhead; Mr. G. Keillor, of Musselburgh, to Comrie; Mr. J. Dickson, to Kelty; Mr. T. Watson, to Girvan; and Mr. J. Campbell, to Polmont.

The obituary contains the names of Mr. S. Stewart, late of Greenock; Mr. J. M'Gilchrist, of Dumbarton; Mr. A. D. Robertson, of Oban; Mr. J. Hall, of St. Andrews; and Mr. J. B. Terrace, formerly of Brechin.

The opinion I expressed last year, that there was every appearance of coal rising in price, has been confirmed. As compared with the prices ruling a year ago, there is an increase, all over, of about 2s. per ton. The increases in price, however, were very slight till after the middle of the year, by which time most of the coal for gas undertakings, including all the principal ones, had been contracted for, and in such cases coal supplies for the year have only been advanced by from 1d. to 6d. per ton; the average advance being about 3d. As it has been agreed that the miners are to receive an advance in wages equal to 6¼ per cent., it is probable that there will be another rise in the prices of coal in 1907. Gas oils are reported to have advanced during the year by about 5s. per ton.

This completes my observations as to gas affairs in Scotland in 1906. The year will not be a memorable one, either in the matter of good report or ill report; but these "Notes" which I have written indicate a still rising tide. To use another metaphor, the barometric reading of all reliable returns is in the upward direction; and the feature upon which we ought all to congratulate ourselves is that the upward movement is so steady, on account of its giving ground for the expectation that, being steady, it will also be permanent.

The Gas Commissioners of the Edinburgh and Leith Corporations on Monday instructed that, in view of questions which have been raised by the Corporation of Edinburgh as to the testing of gas, excerpts from the Edinburgh Corporation expert's report should be printed and circulated among the members for their consideration. The Commissioners remitted to Committees to consider the notices which have been given of applications for statutory powers, in so far as they affect their interests. One of these was mentioned by Mr. Herring, the Engineer, as affecting the Commissioners' interests very seriously. It is an application for power to run an electric tramway between Edinburgh and Dalkeith; and it was stated that, in parts of the route which is proposed, there are as many as five lines of pipes, and in one place two trunk mains. Mr. Herring urged that it was most important that they should have their pipes protected from injury, as well as that they should have access to them, at any time, for repair. A letter from the Town Clerk of Edinburgh was submitted, in which it was pointed out that the Commissioners' Act of Parliament of 1888 provided for the appointment of a testing place or places, and the question was put whether the Commissioners had, by minute, either before or after the opening of the Granton works, fixed a gas-testing place under the statute. If so, he would be obliged if the Commissioners would send him an excerpt of that minute. Mr. Herring explained that, originally, the testing-places were minuted as the gas-works in Leith and the office of the Commissioners in Waterloo Place. He thought it was in 1899 that they adopted as a testing-place the Edinburgh works, instead of Waterloo Place. Then, when the Edinburgh works were closed, as a natural consequence, the testing-place was established at the Granton works. The Clerk was instructed to ascertain if there were a minute upon the subject, and to let the Town Clerk have the information he desired.

In the Glasgow Sheriff Court on Monday, Sheriff-Substitute Fyfe heard parties in a petition by the Liquidator of Thomas's, Limited, of Glasgow, to have the Corporation of Glasgow interdicted from cutting off the gas and electricity supply from the premises of the Company; this action having been threatened because of the non-payment of an account incurred previous to the appointment of the Liquidator. For the Liquidator, it was contended that the Corporation were only entitled to a preference over the other creditors. He was quite prepared to undertake that the supplies of power and lighting provided after his appointment would be paid for. The Liquidator, it was claimed, was in the same position as a new occupier of premises, and was, by the Companies Act of 1862, in a better position than a bankrupt. For the Corporation, it was argued that, by their Act of 1869, they had power to cut off the supply of gas to any persons who failed to pay their accounts. The word "person" included the liquidator of a company. It had been judicially determined that a liquidator was only an agent. The Sheriff said that the Corporation had a statutory power, and he was of opinion that a liquidator was not in the position of a new tenant. He therefore refused interdict.

In the Sheriff Small Debt Court at Hamilton last week, John Ramsay, a plumber, sued the Corporation of Hamilton for damages in respect of his gas supply having been cut off because of his non-payment of the quarterly account for gas due in September. The gas supply, the pursuer contended, ought not to have been cut off, in respect that the Corporation had in their possession a deposit by him, which was more than sufficient to pay the account rendered. The account, he also said, was not rendered till the 24th of November, and he was entitled to a month's credit after that date. The Corporation claimed payment of an account for supplies over and above the gas consumed. Evidence was led, from which it appeared that Ramsay had called a meeting of his creditors, and that, on the day following, having met an employee of the Gas Department on his way to cut off the gas, he went to the Burgh Chamberlain's Office and asked for his accounts. These could not then be produced, and he promised to return the following day. The next day was a Saturday, and he said he was detained at work till after the Chamberlain's Office was closed, and could not, therefore, attend. On the Monday, he had another engagement, and could not go to the Chamberlain's Office. The gas was cut off that forenoon. The Sheriff-Substitute dismissed the claim for damages, and found for the Corporation, with modifications in respect of the deposit and of part of the account for gas being incurred prior to Ramsay's entry into his present house.

On Tuesday, there was a violent explosion of gas in a dwelling-house in Brown's Close, Bridgeton, Kirkcaldy, occupied by a Mrs. Stirling. The woman had been searching with a light for an escape of gas in a passage. A good deal of damage was done; one of the walls of the house having been partly blown out, and the ceiling broken in several places. The windows were also smashed. Mrs. Stirling and a grandchild who was with her in the house escaped with slight burns on their faces and hands.

On Wednesday evening, an unmarried woman named Ann Low was found lying dead in her house in Ladyloan, Arbroath. She had not been seen during the day, and the police, on being informed of her disappearance, had the door of the house forced. The gas was found to have been turned on; but there was no gas escaping into the house at the time—the gas-meter having apparently been frozen. Death was, however, certified as having been due to asphyxiation by coal gas.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 29.

Sulphate of Ammonia.

The week has been much broken by holidays, and the business done has only been on a very limited scale. Contracts for the month being practically covered, buyers have been scarce; while makers whose stocks are not inconvenient have been inclined to wait for the light of another year for the chance of some improvement in values. Meantime the nearest quotations are £11 12s. 6d. per ton f.o.b. Hull, £11 13s. 9d. to £11 15s. per ton f.o.b. Liverpool, and £11 17s. 6d. per ton f.o.b. Leith. There has been nothing doing in the forward position.

Nitrate of Soda.

This article has also been quiet, though with a firmer tone for forward delivery. Spot prices are 11s. 3d. per cwt. for 95 per cent., and 11s. 10½d. per cwt. for refined quality.

LONDON, *Dec.* 29.

Tar Products.

Owing to the holidays, there has been very little doing during the past week, and it is not probable that we shall see any great alterations until after the New Year. Pitch is very weak; and manufacturers do not appear to have entirely cleared out the quantities which they wish to dispose of for delivery over the first few months of the year. Some quantity of London pitch was sold for prompt delivery at 25s.; while on the east coast 24s. 6d. has been accepted in more than one instance for January-February delivery. In the west, manufacturers report having endeavoured to sell at 24s. 6d. Liverpool for prompt delivery without success; while business has been done in South Wales at prices which will not leave more than 24s. to 25s. at places on the West Coast, according to the freight which has to be paid. There is little business doing on the Continent, where consumers appear to be willing to purchase only for delivery over the last three or four months of 1907. Creosote is very firm. It is reported that some quantity of London oil was sold at 2d. per gallon; but the large manufacturers will not look at anything like this figure. In fact, second-hand oil is selling at 2⅛d.; while makers themselves do not care to entertain business at under 2¼d. to 2⅜d. In the Midlands, there is very little to spare, and makers do not seem at all anxious to sell. In the North, some quantity of oil is reported to have been sold at 1⅞d.; but most of the makers are asking 2d. per gallon, and will only offer small quantities even at this figure. Carbolic acid remains steady. Continental consumers refuse to pay more than 1s. 8½d. for prompt; but manufacturers are well sold, and appear quite willing to stand out of the market until prices improve. In crystals, no business of importance is reported, but small quantities are sold from time to time at the market price. Benzol 90 per cent. is very firm in London; and for prompt delivery this article is very difficult to obtain. In the North, manufacturers are evidently fairly well sold, and will not entertain business except at very good figures. There is no alteration in 50-90 per cent.; and prices remain unchanged. In toluol there is no change in the price of ordinary 90 per cent., but purchases of pure are reported at advancing rates. Solvent naphtha is still very firm. London manufacturers are well sold, and do not seem inclined to consider any further business just at present; while 1s. 3d. per gallon is again reported to have been paid for January-June upon the east coast.

The average values during the week were: Tar, 14s. to 18s. Pitch, London, 25s. to 25s. 6d.; east coast, 24s. 6d. to 25s.; west coast, 24s. to 25s. Benzol, 90 per cent., 1s. to 1s. 1d.; 50-90 per cent., 11½d. to 1s. 0⅜d. Toluol, 1s. 1½d. to 1s. 2d. Crude naphtha, 4⅜d. to 5½d.; solvent naphtha, 1s. 3d. to 1s. 5d.; heavy naphtha, 1s. 3d. to 1s. 5d. Creosote, London, 2⅛d. to 2¼d.; North, 1⅞d. to 2d. Heavy oils, 2⅛d. to 2⅜d. Carbolic acid, 60 per cent., 1s. 8¾d. to 1s. 9d. Naphthalene, £4 10s. to £9 10s.; salts, 33s. to 35s. Anthracene, "A" quality, 1⅛d. to 1⅜d.

Sulphate of Ammonia.

The market closes quiet, and there is very little business doing. The principal Gas Companies maintain their quotation of £12 5s. on Beckton terms; but business has been done in ordinary London make at equal to £11 10s. In Hull, business is reported to have been done at £11 12s. 6d.; while £11 15s. was offered for a very fine make, but the manufacturer refused this bid. In Liverpool, business is reported at £11 13s. 9d. to £11 15s.; while in Leith, the value may be taken as £11 17s. 6d. to £12, though no business is reported to have been done. For forward delivery the market is firm; but manufacturers at present refuse to consider the prices offered by dealers.

Electric Light Failure at Cardiff.—The electric light seems to have a weakness for going out just when shopkeepers are particularly busy. The latest instance of this peculiarity has been furnished at Cardiff, where, in certain districts, there were failures on Christmas Eve. Naturally the breakdown occasioned considerable inconvenience; and we are told that the tradespeople of the locality were the objects of much sympathy. This, however, must be poor consolation for such an interference with their business on what is, perhaps, the busiest day of the whole year.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The sudden change in the weather has given an impetus to the coal trade, especially in house qualities. It has also made an impression on gas coal and cannel, by greatly increasing the demand. Miners wages having been raised 5 per cent., coal prices are being increased to-day 5d. per ton in the Manchester district, and something like double that amount outside. During the year just closed, the total tonnage of coal which has left the Manchester Ship Canal reaches at least 620,000 tons. Lancashire, Yorkshire, Nottinghamshire, and Derbyshire collieries have participated in this large export trade. On the whole, the trade in coal from this part of the country for the past year has been greater in volume than ever before; and the prospects, so far as can be seen, are of a most satisfactory character.

Northern Coal Trade.

There has been a very keen demand for coals in the last few days; and the production has been greatly lessened by the holidays—the number of miners at work being much below the usual. In the steam coal trade, the price has been irregular, because the limited supply was mainly taken up by contract quantities, and any small lots commanded high values. Best Northumbrian steams were quoted from 12s. 6d. to 12s. 9d. per ton f.o.b., where early delivery could be given, second-class steams were 11s. to 11s. 3d., and steam smalls from about 7s. to 8s. The prices are, however, ruled by the time of delivery, and vary rather more than usual. Gas coal is at the height of the demand, and the deliveries have been fair under the circumstances for the long contracts; but any available lots beyond these commanded high prices. Durham gas coals vary from about 10s. to 11s. 3d. per ton f.o.b. generally; but for some special kinds, up to 12s. has been asked. Some small lots of coal have been contracted for at near the current values; and a large Danish contract is under negotiation, but nothing is known yet as to the prices that may rule. Coke is scarce and firm. This favourably influences gas coke, which is plentiful, and is now quoted at about 13s. 6d. per ton f.o.b. in the Tyne for good descriptions.

Scotch Coal Trade.

Trade closed for the year in the same active condition in which it has been for the past two months. In addition to commercial purposes, the cold weather made a great demand arise for household requirements. Prices are still tending upwards; the quotations last week having been: Ell 10s. 3d. to 11s. 6d. per ton f.o.b., splint 11s. 6d. to 11s. 9d., and steam 10s. to 10s. 3d. The shipments for the week amounted to 292,621 tons—an increase of 36,144 tons upon the preceding week, and of 13,246 tons upon the same week of last year. For the year to last week, the total shipments were 13,648,463 tons—an increase of 1,396,304 tons upon the corresponding period.

Messrs. John Wright and Co. have fitted up the following places of worship at Newport (Mon.) with their gas-heated radiators: St. Matthew's Church, Mount Zion Chapel, the Presbyterian Chapel, and the Jewish Synagogue; also St. Mary's Church, Cwmbran.

Charge to Prepayment Consumers at Lancaster.

In a report submitted to the last meeting of the Lancaster Town Council, the Gas Manager (Mr. C. Armitage) showed that to fix a uniform rate, and supply 30 cubic feet for 1d. to all prepayment customers, would make a reduction of £521 per annum. This arrangement would then entitle all prepayment consumers to have a cooker supplied and fixed free. The extra price charged for prepayment consumers should, he said, be sufficient to cover the extra cost of meter and cooker fixed complete, and of collection of money, and also to obviate the desire of consumers by ordinary meters to change to prepayment meters, as this would necessitate the purchase of extra prepayment meters and throw a corresponding number of ordinary ones idle. The present difference in the charge does not deter some consumers from changing an ordinary for a prepayment meter; and there appears to be already a growing tendency in this direction. The primary object in introducing the prepayment meter, however, was to reach a certain class of customer, and not to change from quarterly accounts to the prepayment system. Each penny reduction per 1000 cubic feet to ordinary consumers would be equal to £600 per annum. The estimated surplus profit for the current year is £2926; and the amount promised in aid of the rates is £2000. The Gas Committee stated that, on receipt of the report, it was resolved that the amount of gas supplied to consumers by prepayment meters be increased from 25 to 30 feet for 1d., such charge to include the cost of a cooker. Also that the question as to the charge to be made for gas supplied to ordinary consumers be deferred until the estimates for next year are considered. On the suggestion of the Finance Committee, however, the Council agreed to defer for another month consideration of the Gas Committee's resolution as to the price to be charged to the prepayment consumers.

Further Money Required at Brighouse.—The Brighouse Town Council have resolved that application be made to the Local Government Board for power to borrow £15,000 for the Gas Department, divided as follows: £6000 as additional working capital, £4000 for gas-stoves, &c., out on hire, and £5000 for penny-in-the-slot gas-meters. Alderman Healey, the Chairman of the Gas Committee, in moving the resolution to this effect, explained that for some time they had been working without the necessary capital, with the result that they had had a large bank overdraft, for which it was necessary to pay interest. They believed they could save considerably by borrowing the money, and paying annual instalments of principal and interest combined.

Gas-Stoves on Walls.—"Hang the gas-stove on the wall." This, according to the "Ironmongers' Chronicle," is the new principle adopted by an ingenious German professor in the stove he has recently put on the market. Our contemporary says it may be described as consisting essentially of a burner heating a number of tubes through which the air flows—entering them cold, and passing swiftly into the general atmosphere of the room at a high temperature. The burner and the tubes are concealed in an ornamental casing open at the foot, from which depends a reflector to throw the radiant heat of the burner into the room. The air to be warmed flows up behind this reflector and round the back part of the casing before passing through the heating-tubes, so that there is no risk of burning the wall.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 16.

Issue.	Share.	When Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Oct. 12	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
245,112	10	,,	7½	Do. 7 p.c.	14—15	..	5 0 0
200,000	5	Nov. 14	7	Bombay, Ltd.	6¾—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	5—5½	..	5 1 10
50,000	10	Aug. 30	14	Bourne- mouth Gas and Water — 10 p.c.	28—29	..	4 16 7
51,810	10	,,	7	Bourne- mouth Gas and Water — B 7 p.c.	17—17½	..	4 0 0
53,200	10	,,	6	Bourne- mouth Gas and Water — Pref. 6 p.c.	15—16	..	3 15 0
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	260—265	..	4 14 4
300,000	,,	,,	9⅜	Do. New	200—205	..	4 12 8
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—125	..	4 0 0
206,250	,,	Dec. 13	4	Do. 4 p.c. Deb.	101—104	..	3 16 11
220,000	Stk.	Sept. 27	11¼	Brighton & Hove Orig.	230—235	..	4 15 8
246,320	,,	,,	8¼	Do. A. Ord. Stk.	163—168	..	4 18 3
460,000	20	Sept. 27	10	British	41—43	..	4 13 0
104,000	Stk.	Aug 15	6	Bromley, Ord. 5 p.c.	121—125	..	4 16 0
165,700	,,	,,	4½	Do. do. 3½ p.c.	91—94	..	4 15 9
500,000	10	Oct. 12	7	Buenos Ayres (New) Ltd.	11½—12	..	5 16 8
250,000	Stk.	Dec. 13	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
150,000	20	July 12	8¼	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	Sept. 27	10	Cape Town & Dis., Ltd.	14—15	..	6 13 4
100,000	10	Oct. 26	4½	Do. 4½ p.c Pref.	9½—10	..	4 10 0
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	Dec. 28	4½	Do. 4½ p.c. Deb. Stk.	96—98*	..	4 11 10
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord.	108½—110½	..	4 10 6
1,443,280	Stk.	Aug. 30	5⅛	Commercial 4 p.c Stk.	110—113	..	4 12 0
560,000	,,	,,	5	Do. 3½ p.c. do.	107—110	..	4 10 11
475,000	,,	Dec. 13	3	Do. 3 p.c. Deb. Stk.	83—85	..	3 10 7
800,000	Stk.	,,	6½	Continental Union, Ltd.	124—127	..	5 2 4
200,000	,,	,,	7	Do. 7 p.c. Pref.	138—143	..	4 17 11
432,070	Stk.	Aug.	3½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	July	4	Do. Deb. Stk.	105—107	..	3 14 9
486,090	10	July 27	11	European, Ltd.	24½—25½	..	4 6 3
354,060	10	,,	11	Do. £7 10s. paid	18—19	..	4 6 10
15,203,110	Stk.	Aug. 15	4 5/8	Gas-light and Coke — 4 p.c. Ord.	98½—99½	..	4 8 5
2,600,000	,,	,,	3½	Gas-light and Coke — 3½ p.c. max.	88—90	..	3 17 9
3,799,735	,,	,,	4	Gas-light and Coke — 4 p.c. Con. Pref.	107—110	..	3 12 9
4,193,975	,,	Dec. 13	3	Gas-light and Coke — 3 p.c. Con. Deb.	84—86	..	3 9 9
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	98—103	..	4 17 1
82,500	,,	,,	6½	Do. do. 5 p.c.	118—121	..	5 7 5
70,000	10	Oct. 12	11	Hongkong & China, Ltd.	19¾—20½	..	5 7 4
4,940,000	Stk.	Nov. 14	8	Imperial Continental	177—180	..	4 8 11
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	95—97	..	3 12 2
183,242	Stk.	Aug. 30	6	Lea Bridge Ord. 5 p.c.	120—125	..	4 16 0
306,083	,,	June 28	4	L'rpool Unit'd Deb. Stk.	110—112	..	3 11 5
561,000	Stk.	Aug. 30	10	Liverpool United A	229—231	..	4 6 7
718,100	,,	,,	7	Do. B	167½—165½	— ½	4 3 1
144,140	Stk.	Sept. 13	7⅞	Maidstone 5 p.c.	145—150	..	5 1 8
75,000	5	Nov. 29	5	Malta & Medn., Ltd.	4¼—4⅜	..	5 5 3
560,000	100	Oct. 1	5	Met. of — 5 p.c. Deb.	101—103	..	4 17 1
250,000	100	,,	4½	Melbourne — 4½ p.c. Deb.	101—103	..	4 7 5
541,920	20	Nov. 14	3¾	Monte Video, Ltd.	11½—12½	..	5 12 0
1,675,892	Stk.	Aug. 15	4⅜	Newc'tle & G'tesh'd Con.	111⅛—112½	..	4 2 3
406,025	Stk.	June 29	3½	Do. 3½ p.c. Deb.	98—99	..	3 10 8
15,000	10	Aug. 30	10	North Middlesex 10 p.c.	20—21	..	4 15 3
55,940	10	,,	7	Do. 7 p.c.	13½—14½	..	4 16 7
300,000	Stk.	Nov. 29	8	Oriental, Ltd.	150—155	..	5 3 3
60,000	5	Sept. 13	7	Ottoman, Ltd.	5⅞—6⅜	..	5 12 0
398,490	5	Oct. 26	7	Primitiva Ord.	7⅜—7¾	— ⅛	4 10 4
796,980	5	July 27	5	Do. 5 p.c. Pref.	5⅜—5⅝	..	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
851,070	10	Oct. 12	7	River Plate Ord.	12¼—12⅝	..	5 7 8
300,000	Stk.	Dec. 28	4	Do. 4 p.c. Deb.	95—97*	..	4 2 6
250,000	10	Sept. 27	8	San Paulo, Ltd.	13¼—13⅝	..	5 16 5
70,000	50	July 2	5	Do. 5 p.c. Deb.	49—51	..	4 18 0
135,000	Stk.	Sept. 13	10	Sheffield A	246—248	..	4 0 8
209,984	,,	,,	10	Do. B	246—248	..	4 0 8
523,500	,,	,,	10	Do. C	246—248	..	4 0 8
70,000	10	Oct. 26	10	South African	15½—16½	..	6 1 3
6,350,000	Stk.	Aug. 15	5½	South Met., 4 p.c. Ord.	128—130	..	4 4 7
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	85—87	..	3 9 0
201,720	Stk	Sept. 13	8	South Shields Con. Stk.	156—158	..	5 1 3
575,000	Stk.	Aug. 15	5½	S'th Suburb'n Ord. 5 p.c.	123—126	..	4 7 4
60,000	,,	,,	5	Do. 5 p.c. Pref.	123—126	..	3 19 4
112,533	,,	July 12	5	Do. 5 p.c. Deb. Stk.	128—133	..	3 15 2
502,310	Stk.	Nov. 14	5	Southampton Ord.	105—110	..	4 10 11
120,000	Stk.	Aug. 30	6½	Tottenham and — A 5 p.c.	127—130	..	5 0 0
388,020	,,	,,	5	Tottenham and — B 3½ p.c.	104—106	..	4 14 4
137,500	,,	Dec. 28	4	Edmonton — 4 p.c. Deb.	101—103*	..	3 17 8
182,380	10	,,	8	Tuscan, Ltd.	10½—11*	..	7 5 6
149,900	10	July 2	5	Do. 5 p.c. Deb. Red.	104—106	..	4 14 4
193,742	Stk.	Sept. 13	5	Tynemouth 5 p.c. max.	106—108	..	4 12 7
30,000	Stk.	Aug. 15	8	Wands- worth and — A 5 p.c.	—	..	—
255,636	,,	,,	6½	Wands- worth and — B 3½ p.c.	140—145	..	4 9 8
75,000	,,	,,	5⅝	Wands- worth and — C 3½ p.c.	113—115	..	4 17 6
79,416	,,	Dec. 28	3	Putney — 3 p.c. Deb. Stk.	79—82*	+½	3 13 2
779,875	,,	Aug. 15	5⅛	West Ham 5 p.c. Ord.	102—104	..	4 18 6
185,000	,,	,,	5	Do. 5 p.c. Pref.	120—123	..	4 1 4
193,300	,,	Dec. 28	4	Do. 4 p.c. Deb. Stk.	101—104*	..	3 16 11

Prices marked * are "Ex div."

Diaries and Calendars.

As usual at this season, we have received many diaries and calendars for the New Year, and now briefly acknowledge some. A useful blotting-pad, with an interleaved diary (a week on a page) attached, has been sent by the Parkinson branch of Parkinson and W. & B. Cowan, Limited, whose specialities are shown in the centre of each sheet of blotting-paper. From the Cowan branch of the same firm, we have received one of the neat pocket-books they send out annually, containing prices and particulars of their wet and dry gas-meters. Another blotting-pad, sent by Messrs. Gibbons Bros., Limited, of Dudley, will be found serviceable in a gas manager's office. From Messrs. Fletcher, Russell, and Co., Limited, we have received a block office calendar, showing on each day one of their stoves. A diary sent by Messrs. F. C. Sugden and Co. gives particulars of Hudson's patent producer, as applied to their regenerative and generator settings. Inserted in the diary is a £1000 railway accident insurance policy, which should ensure for the book a place in the recipient's pocket. The Simon-Carvès Company have sent us one of their tastefully got-up block calendars, with the usual excellent selection of quotations from celebrated authors. We have also to acknowledge, from Messrs. Hazell, Watson, and Viney, Limited, their well-known "Annual" for the present year, which contains several new and interesting features. In addition to recording the news of the world up to date, there are specially-written articles dealing with the principal events of the year 1906, which make the book of exceptional value. A glance through its 700 pages shows that the Editor, Mr. W. Palmer, B.A. (Lond.), has noticed every leading politician or public man who in any way came into prominence during the past year. The contents of the book, revised to the 1st ult., are arranged in alphabetical order, and there is a special index. The "Annual" is published by Messrs. Hodder and Stoughton, of Paternoster Row, E.C. The Winstanley Speciality Company, of Birmingham, have sent us a neat little pocket diary and engagement book (one of the Charterhouse series), containing an insurance coupon of the Ocean Accident and Guarantee Corporation.

The Snowstorm and the Devonport Water Supply.—One effect of the heavy snowfall on Dartmoor on Christmas Day was to block up the leat which supplies Devonport with water. The leat is an open channel for many miles, and the snow drifted into it at two points—one near Princetown and the other at Roborough. Mr. Lillicrap, the Borough Water Engineer, took immediate steps to have the channel cleared; and a large number of men were set to work to dig out the snow. Difficulties of this kind will be reduced when the works proposed to be executed under the Devonport Corporation's new Water Act are carried out, as the supply will be piped for part of the distance in which it now flows in the open leat. In consequence of a similar, but worse, experience in 1891, Plymouth decided to discontinue the use of the leat which had served the town since the days of Sir Francis Drake, and laid a main for the conveyance of the water to the town.

A Good Outlook at Tipton.—At last month's meeting of the Tipton Urban District Council, a letter was read from the District Auditor alluding to the overdraft on the accounts of the gas-works, amounting to £4000, which he stated it was absolutely necessary should be liquidated at the earliest possible moment. The Chairman (Mr. J. Powell) said that there was a prospect of securing such profit from the undertaking as would enable the Council not only to comply with the request of the Auditor, but reduce the price of gas in April.

The Uses and Bye-Products of Coal.—On Thursday, the 20th ult., a lecture on the above subject was delivered in the Friends' School-room, Stockton-on-Tees, under the auspices of the "Friend" Lodge of Good Templars, by Mr. Matt. Dunn, the Assistant-Engineer at the gas-works. In the course of his lecture, Mr. Dunn dealt with the comparative values of electricity and gas for lighting purposes, and illustrated his remarks by practical demonstrations. He was listened to by a large and appreciative audience, and everything passed off satisfactorily.

Cost of Gas and Electricity at Ipswich.—The Ipswich Town Council have renewed their contract with the Gas Company for lighting the street-lamps, upon the same terms as at present; but before the recommendation of the Lighting Committee to this effect was agreed to, one member asked if the question of lighting some of the thoroughfares with electricity had been considered. The reply of Mr. H. W. Raffe, on behalf of the Committee, was that the cost of gas was considerably less for an equal amount of light; but that if the Corporation were prepared to pay 25 or 30 per cent. more for lighting the town with electricity, the Committee would go into the subject. He always understood that Ipswich was one of the best lighted towns in the whole of England. Mr. Pretty said the Electric Light Committee offered to put a lamp up on trial; but they had had no reply. Mr. Raffe: We had the cost; and that is what we had to go by.

Municipal Electricity Supply at Woolwich.—Referring to the electricity supply undertaking of the Woolwich Borough Council, of which mention is made in the review of electric lighting in the past year which appears elsewhere, the "Pall Mall Gazette" a few days ago said: "The promoters of the County Council's electric trust cannot draw much encouragement from the experience of Woolwich under municipal management. Sir Alexander Kennedy, who has been called in as an expert to advise on the electrical undertaking, gives the Borough Council exceedingly cold comfort. The whole enterprise must be reorganized, he says, and even then it cannot show a profit for many years. There are two fully-equipped stations where there need only have been one, much machinery is idle, the staff is too large, and (naturally) nothing has been allowed for depreciation. The borough has spent a quarter-of-a-million already on the electric toy; and Sir Alexander Kennedy suggests that, instead of plunging to regain its losses, the Council should consider the advisability of taking a bulk supply from a private company. It will be no joke when the same sort of song has to be sung to the tune of many millions."

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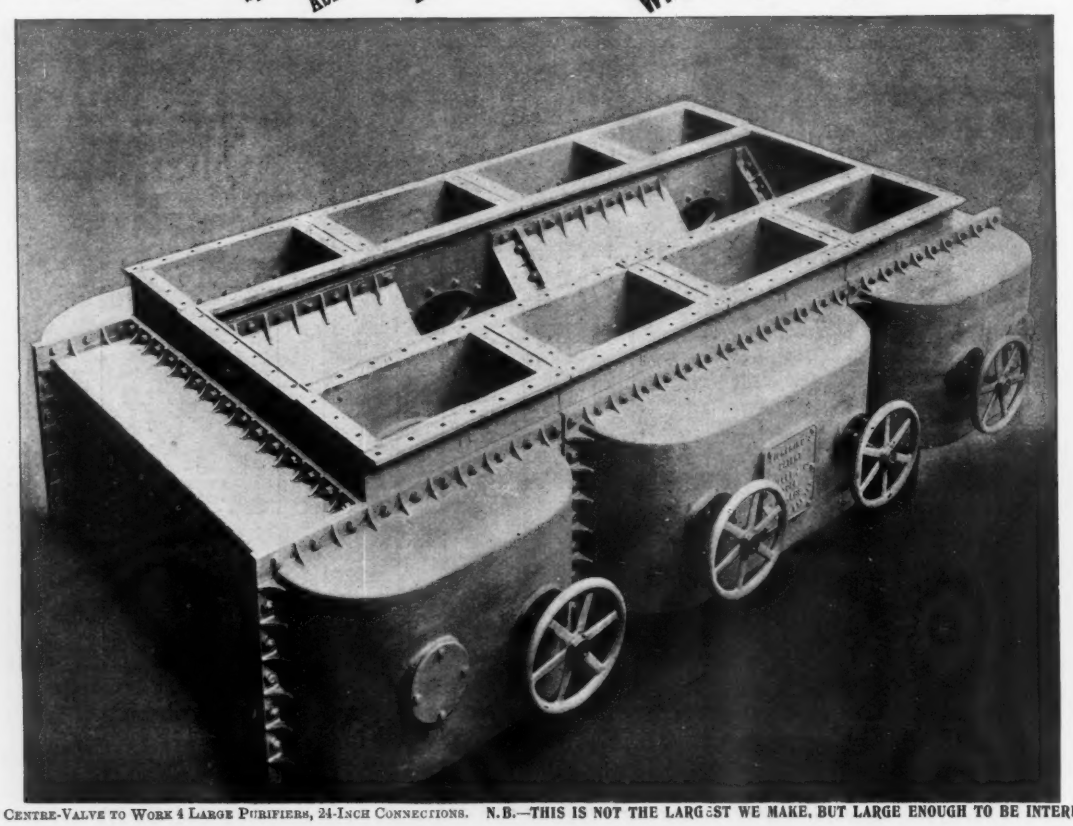


VIEW OF CENTRE-VALVE TO WORK 4 LARGE PURIFIERS, 24-INCH CONNECTIONS. N.B.—THIS IS NOT THE LARGEST WE MAKE, BUT LARGE ENOUGH TO BE INTERESTING.

Coventry Gas-Fitters and the Corporation.—The Gas Committee of the Coventry City Council have further considered the memorial from the Coventry Gas and Electrical Engineers' Association with respect to the supply of fittings, &c., by the Gas Department, which was discussed at the last meeting and adjourned. It was resolved that the Committee cannot see their way to make any alteration in the present practice.

Gas Explosion and Fire at Lancaster.—While a man named Thomas Rose was engaged in lighting a fire last Sunday morning in his cottage in Graham Street, Lancaster, a violent explosion occurred, which blew out the windows, set fire to the room, and severely burnt Rose. Two other cottages were also set on fire; and the brigade were several hours engaged in putting out the flames. It is said that an accident to the service-main caused the explosion.

Record Gas Consumption in Manchester.—The week ending Dec. 20 was a record one in Manchester, as regards the consumption of gas, which, owing to several days of very thick fog, amounted to 165,126,000 cubic feet. The previous record was 160,578,000 cubic feet, for the week ending Dec. 25, 1904, when there was an even thicker fog. The return for the nine months since April 1 last shows an increase of 6¼ per cent. as compared with the same period of the preceding year; while the day consumption increased 21 per cent.

Arc Electric Lighting at Croydon.—There was great discussion at Croydon not long since over the question of making certain extensions of the electric arc lamps in order to bring more grist to the Corporation electricity mill. But discontent with the arc lighting must be brewing when "Argus" writes thus in the "Croydon Advertiser:" "Some of your readers may not want too much illumination thrown on their doings just at this time; but certainly they have something to complain of in the electric lighting of Croydon. Something ought to be done to make the lights more brilliant, or else we ought not to have to pay for the present arc electric lamps, which are little better than a delusion and a snare. Why, the gas-lamps, with incandescent burners, are better by far. They do light the roads and the footpaths. What is the good of an arc electric lamp which only lights the firmament and gives the stars a chance?"

The New Gas-Works at Hathersage.—In a paragraph on this subject which appeared in the "JOURNAL" for the 18th ult., it was stated that, owing to some mistake with regard to the ironwork, the plant would not be completed by the expected time. We learn from Messrs. J. Firth Blakeley and Co., the sole Contractors for the works, that the mistake alluded to was of a very primitive nature, and that it has not been the means of delaying the completion of the work; such delay having arisen purely from alterations by the Engineer in connection with the buildings, and from the trouble experienced with water through the position of the site selected for the works. Moreover, the weather during the past six weeks has been to a large extent the means of retarding building operations. They add that the retorts and other plant, with the exception of one or two coupling-up pipes, are all ready for gas making; and they expect to finish within another fortnight.

The Award in the Hastings Tramways Arbitration.—In the last number of the "JOURNAL" we announced that the Arbitrator in the Hastings Tramways case (Mr. H. Graham Harris) had decided that it was not necessary to alter the position of the Gas Company's mains. We learn that, under the terms of the award, the parties are to bear in equal proportions the expense of excavating and making good the trial holes made for his inspection; and that they are also to pay their own costs of the reference.

Fatal Accident at the Bury Gas-Works.—A verdict of "Accidental death" was returned by the Jury who inquired into the death of John Taylor, an oiler and greaser at the Bury Corporation Gas-Works, who met with a fatal accident last Sunday week. He was examining a retort-discharger, when his head caught between a portion of the machine and an angle iron. The machine was moving at the time, and his head was fearfully crushed, causing fracture of the base of the skull. Deceased died soon after admission to the infirmary.

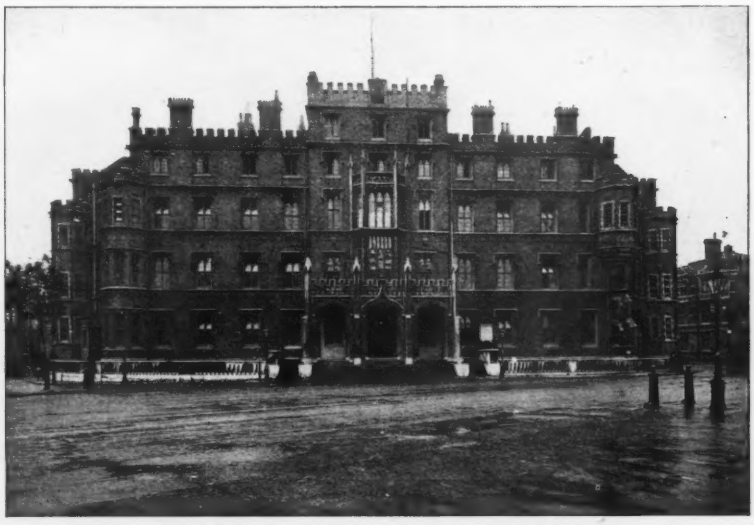
Gas-Meter Testing in Manchester.—In their annual report, the Manchester City Justices' Committee for the Gas-Meter Testing Department state that the index-test is applied to all gas-meters tested on behalf of the Corporation; and the result is that in the Manchester area only accurate meters are now supplied to consumers, who thus possess a privilege which the members of other municipalities will not enjoy until the present law has been amended and the "double test" made compulsory, or until arrangements have been effected similar to those in operation in Manchester.

The Financial Position of the Swadlincote Gas Undertaking.—In the "JOURNAL" last week, we gave some figures from the report of Mr. Alderman Hart, of Derby, who was called in to examine the accounts of the Swadlincote gas undertaking for the year ending the 31st of March last, which had been adversely criticized in the Urban District Council. It was then stated that a special meeting was to be held, to which Alderman Hart was to be invited to explain some of his figures. Meanwhile, the local papers seem to be quite satisfied with the result of the independent investigation, as will be gathered from the following comments in the "Burton Mail:" "It seems clear that the gas management have erred but slightly in assessing the profit for the year ended last March. The department, after paying off a very large charge for instalments of capital and interest, have made a profit of £934; whereas the Council's own officials assessed it at about £971—not a very material difference." Referring to the remarks of Mr. Howard as to the price of gas, the writer says: "What Mr. Howard and his like overlook is that the business of the Gas Department is gradually purchasing the works for the community. . . . If councillors' statements as to the figures of the report are authentic—and we judge they are, since they went unchallenged—the Committee's administration of the gas-works is abundantly vindicated. After paying off the excessive capital charges, they have produced a considerable profit, and deserve well of the Council and their constituents."

RADIATOR PICTURES, No. 11.

A view of a well-known London Institution where

Wright's "ST. ANDREW" GAS-HEATED STEAM RADIATORS are installed.



WESTMINSTER HOSPITAL, LONDON.

Sales of Shares.—At the White Lion Hotel, Hyde, a few days ago, Mr. C. H. Brogden offered for sale £1000 of 7 per cent. stock of the Hyde Gas Company, in lots of £100; and the prices realized ranged from £160 to £162 10s. per lot. On the same occasion, some original £10 shares (10 per cent.) in the Company fetched £26 10s. and £26 12s. each. At a recent auction sale, 35 £10 ordinary shares in the Wey Valley Water Company realized from £14 to £14 2s. 6d. each; and 100 £20 5 per cent. cumulative "B" preference shares in the Farnham Water Company, from £25 to £25 15s. each.

Fixing Gas Appliances.—In an article on this subject in the current number of the "Ironmonger," the writer emphasizes the point that it is never economical to starve the supply of gas. The service-pipe to the apparatus should be of the same size, at least, as the maker's fitting on it; and if the service is a long one, a size larger pipe should be used. If compo. pipe is employed, it should never be taken right up to the fitting. Burners, particularly atmospheric ones, should they light-back, are liable to become hot enough to melt a soldered joint; and consequently the pipe next the fitting should be copper or iron, with screwed joint, for about 3 feet from the connection on the stove. It is best to use wholly hard-metal pipe where possible.

An Unfortunate Result of the High Price of Copper.—The public lamps in quiet spots in the districts surrounding Cardiff have been raided recently, owing, as a local paper puts it, to the increase in the price of copper. The frames of the lamps are made of copper; and it is believed that the thief or thieves take out the glass and roll up the metal. Though the Cardiff Gas Company and the District Councils concerned have offered substantial rewards for the discovery of the depredators, up to the present only one arrest has been made; but while this man was in custody other lamps were stolen, which goes to prove that the thefts are the work of an organized gang. The value of each lamp is about 25s.; but the copper taken and sold as waste only realizes 2s. or 3s.

The Davis Gas-Stove Company, Limited, have just appointed Mr. W. S. Gilbert as their managing representative for London and district.

At the West London Police Court, a few days ago, Catherine Dean was sentenced to 21 days' hard labour for breaking open with a poker a prepayment meter, the property of the Gaslight and Coke Company, and stealing therefrom 16s. 6d. in coppers.

By an advertisement which appears elsewhere, our readers will see that the firm of Messrs. William Grice and Sons, Limited, of Birmingham, has been converted into Grices' Gas-Engine Company, Limited, with works at Carnoustie, as well as in Birmingham.

The Paddington Borough Council have instructed their representative on the Metropolitan Water Board (Mr. Karslake) to request the Board to discontinue cutting off the water supply from premises in respect of which the rate has not been paid, and to substitute legal proceedings where necessary for the recovery of amounts due.

The members of the Windsor and Eton Scientific and Archæological Society recently paid a visit to the works of the Windsor Royal Gaslight Company, on the invitation of the Engineer, Mr. H. Buckley, who, while showing the party round, fully explained the process of gas manufacture. At the conclusion of the inspection, a hearty vote of thanks was accorded to Mr. Buckley.

Messrs. Mather and Sons, of Wellingborough, have just supplied to the Coventry Water-Works pumping plant to lift an additional 300,000 gallons of water per day. The plant consists of a gas-engine of 15-H.P. and a set of three-throw pumps, 11 inches in diameter and 20-inch stroke, driven by intermediate gear at a speed of 21 to 22 strokes per minute. Mr. Charles Hawksley, the Corporation's Consulting Engineer, has superintended the erection of the machinery and the buildings necessary to accommodate it.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

MANAGER. Oswestry Gaslight and Coke Company. Applications by Jan. 12.
ASSISTANT ENGINEER AND MANAGER. Preston Gas Company. Applications by Jan. 8.
OUTDOOR SUPERINTENDENT. Waterford Gas Company.

Situation Wanted.

BOOKKEEPER, SHORTHAND WRITER, AND TYPIST. No. 4686.

Stocks and Shares.

CAPE TOWN AND DISTRICT GAS COMPANY. Jan. 9.
CHIGWELL, LOUGHTON, &c., GAS COMPANY. Jan. 15.
TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY. Jan. 28.

TENDERS FOR

Coal and Cannel.

COPENHAGEN LIGHTING DEPARTMENT. Tenders by Jan. 3.

Fire-Clay Goods.

BOLLINGTON GAS DEPARTMENT. Tenders by Jan. 7.
HEYWOOD GAS DEPARTMENT. Tenders by Jan. 15.

Gasholder (Telescoping).

TEIGNMOUTH GAS DEPARTMENT. Tenders by Jan. 8.

Lead, Lead Pipe, &c.

PLYMOUTH WATER DEPARTMENT. Tenders by Jan. 15.

Mantles.

WANDSWORTH AND PUTNEY GASLIGHT AND COKE COMPANY. Tenders by Jan. 10.

Oxide (New and Spent).

ISLE OF THANET GAS COMPANY. Tenders by Jan. 10.

Tar and Liquor.

HARWICH GAS COMPANY. Tenders by Jan. 5.

Valves, Hydrants, Cocks, &c.

PLYMOUTH WATER DEPARTMENT. Tenders by Jan. 15.

Washer.

MILLOM GAS DEPARTMENT. Tenders by Jan. 29.

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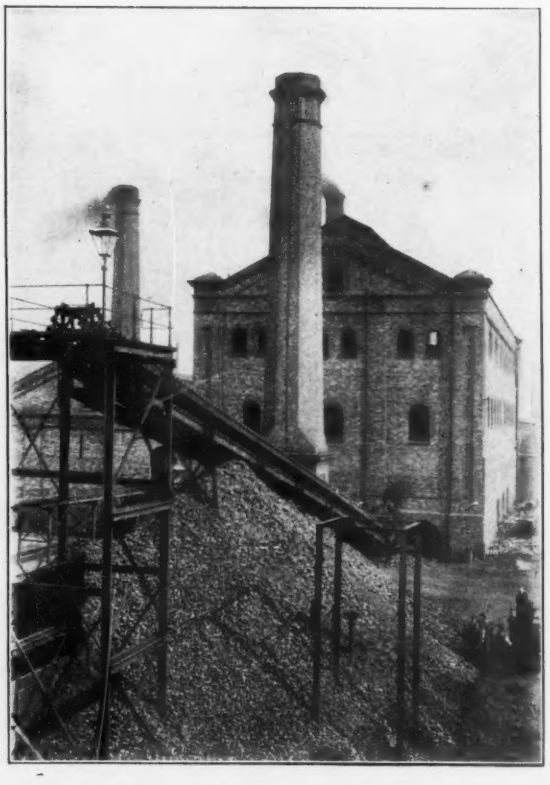

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